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ELECTRIC RAILWAY TRACTION

A Supplement describing developments in Electric Railway Traction is presented with each copy of this week's issue.

Punctuality

THERE is nothing railway travellers appreciate more than punctuality and nothing is liable to be more irritating to them than the reverse. Any measures, therefore, that are taken to improve the standard of punctuality, especially of passenger services, are to be commended and encouraged. The standard in this country compares unfavourably with that maintained in many countries abroad, particularly on the Continent of Europe and in North America, and we have had occasion several times in the last few years to stress this not very creditable fact. In France and certain other European countries, punctuality is encouraged by official instructions to enginemen to regain lost time, a course which is safeguarded by the equipment of locomotives with automatic speed indicators and recorders to detect excessive speed. In this country we have not so far adopted this safeguard, and measures such as appealing to the staff to do their best from disinterested motives have to be adopted. Recognising this, we suggested some time ago the holding of a "punctuality week" during which special efforts should be made to attain 100 per cent. punctual working. It is therefore with particular pleasure that we place on record the fact that last Tuesday the L.M.S.R. held a "punctuality day" which achieved a notable success and to which more detailed reference will be found on a later page. We hope this first step will be followed by regular strides, and that the qualification, which at present includes as nominally punctual trains as much as 5 min. late, may be removed.

* * * *

The Public Relations Department, London Transport

As a public utility corporation operating all forms of passenger transport in and around the Metropolis, the London Passenger Transport Board has found that the importance of its relations with the outside world has outgrown the scope of a departmental section under the control of the Publicity Manager. To meet a growing need the Public Relations Department has just been established and placed under the control of Mr. Edward Rawdon Smith, the former Assistant Secretary to the L.P.T. Board, who now assumes the title of Public Relations Officer. Since the retirement of Mr. George W. Duncan in September last, no permanent appointment of a Publicity Manager has been made, and the present step marks the segregation of the "public information" and the "advertising production" sides of the old Publicity Department. The new department is charged with responsibility for the whole of the relations between the public and the board. The duties include relations with the press; relations between public authorities and associations and the board; the control of all correspondence between the public and the board; arrangements in connection with visits paid to the board's undertakings; and the preparation and supply of official information with regard to the board and its activities.

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The Week's Traffics

Passenger train traffics of the four group companies for the past week were on the whole satisfactory, but merchandise and coal continue downwards, and the only increase to date in general merchandise receipts is that of £18,000 on the Great Western. For the nine weeks of the current year passenger train traffics of the four companies aggregate £8,973,000, an increase of £174,000 or 1·98 per cent. London Transport receipts for the week were £530,800, an improvement of £18,200, bringing the total for the 35 weeks to £18,578,200, which makes an increase of £369,700.

	9th Week				Year to date.	
	Pass., &c.	Goods, &c.	Coal, &c.	Total.	Inc. or dec.	
	£	£	£	£	£	%
L.M.S R. ..	+ 6,000	− 19,000	− 13,000	− 26,000	− 60,000	− 0·62
L.N.E.R. ..	+ 12,000	− 11,000	− 20,000	− 19,000	− 113,000	− 1·56
G.W.R. ..	− 1,000	− 6,000	− 12,000	− 19,000	− 9,000	− 0·23
S.R.	+ 7,000	− 4,500	− 3,500	− 1,000	− 20,000	− 0·68

The Great Northern Railway (Ireland) has an increase of £1,100 for the week, making an aggregate gain of £5,250.

* * * *

The L.M.S. Meeting

In his address to the stockholders of the London Midland & Scottish Railway at the annual meeting last Friday, Sir Josiah Stamp was optimistic as to the continuation of benefits from the real economies already effected and still being pursued. On the prospects of increased traffics he was bound to be less reassuring. Geographically the L.M.S.R. is particularly sensitive to the fortunes of the industries which show less advance—namely, coal, shipbuilding, cotton, wool, &c.—and it serves all the depressed and semi-depressed areas except one. The revival of foreign trade, which is of so much importance to the company, has not yet come. In all the circumstances the Chairman thought there was hope for the company of holding its present position, and indeed making some

advance upon it, but any spectacular leap forward in the near future was unlikely. Amongst encouraging features were the spirit of the staff and their zeal for results which had never been higher than today. Closer contact between the management and the staff was being brought about by educational films which were being sent on tour to the various centres of the company's system. Improved methods of working previously introduced have continued to be progressively productive; the recent comprehensive programme of running shed re-arrangements has had a marked effect on the continuity of the work; and the new arrangements for handling goods at terminal points are bringing about further reductions in operating costs and handling times. Practically 100 per cent. deliveries on the day of arrival were effected in 1934.

* * * *

Northern Counties Committee (L.M.S.)

Like all the railways in Northern Ireland the Northern Counties section of the L.M.S.R. has been hard hit by road competition. In 1933 it also suffered from the strike of eight weeks early in the year. An all-round improvement was shown in 1934 when railway gross receipts improved by £39,902 accompanied by a rise of only £9,230 in railway expenditure, and the net loss on railway working was reduced from £89,285 to £58,613. Net receipts from road transport were £9,843, an improvement of £7,698, and the hotels department made a profit of £3,912, comparing with a loss of £1,270 in 1933. The committee now possesses 52 road motors for goods and parcels and 132 motor omnibuses, on which the sum of £160,251 has been expended on capital account. An interesting item of capital expenditure during 1934 has been that of £5,352 on a diesel railcar. Passengers originating on the system in 1934 numbered 2,503,890, an increase of 449,554, with total passenger receipts of £138,212 against £116,091. Goods train receipts were £145,141, an increase of £12,303, with an originating tonnage of goods of 406,347 against 368,862. General financial results are compared below.

	£ 1934	£ 1933	£ 1932
Capital expenditure ..	3,943,511	3,915,395	3,846,968
Gross receipts from businesses	530,072	489,248	572,280
Revenue expenditure on ditto	574,930	577,658	615,317
Net receipts of ditto ..	*Dr.* 44,858	*Dr.* 88,410	*Dr.* 43,037
Miscellaneous receipts net	7,774	7,341	9,241
Total net income	*Dr.* 37,084	*Dr.* 81,069	*Dr.* 33,796
Interests, rentals, &c. ..	1,341	1,382	1,339

* * * *

Belfast & County Down Railway

For the ninth year in succession the holders of this company's 4 per cent. and 5 per cent. preference stocks and of its ordinary stock have had to go without dividends, though the 4½ per cent. " A " preference stock continues to receive its due for the second half of the year. At the annual general meeting, which is briefly reported elsewhere, the Chairman (Mr. Thomas Richardson) expressed his keen disappointment that the general improvement in trade, which had undoubtedly taken place in many industries, had not benefited the railway as much as he had hoped. Passengers were 2,904,000, or 159,000 more than in 1933, but brought in only £80,800, against £82,264. Goods and mineral tonnage was 98,005 against 94,546, but the receipts rose only from £24,473 to £24,687. In the railway gross receipts of £156,764 there was a drop of £584, and the railway expenditure (£152,184) showed a rise of £1,486 due mainly to special maintenance outlays and partly to the increase of 13,000 in train-miles. Profits from ancillary businesses were £5,908, an increase of £2,322. The accompanying table compares results:—

	1934 £	1933 £	1932 £
Total expenditure on capital account	1,651,235	1,650,351	1,647,678
Gross receipts from businesses ..	200,628	200,123	203,711
Revenue expenditure on ditto ..	190,141	189,887	196,487
Net receipts of ditto	10,487	10,236	7,224
Proportion of compensation under Irish Railways (Settlement of Claims) Act, 1921	569	2,150	1,572
Miscellaneous receipts, net ..	5,719	5,793	7,316
Total net income	16,206	16,029	14,540
Interest, rentals, etc.	13,929	13,929	13,929
Guaranteed and preference dividends	1,635	1,635	1,635
Surplus	1,692	1,050	585

* * * *

Colours for the Sunshine Line

The somewhat sombre green in which Southern Railway locomotives and rolling stock are painted evoked criticism from a shareholder at the general meeting of the company last week. Maintaining that something more in keeping with the sunny traditions of the south was desirable, he proposed blue for the engines and maroon and white for the carriages. But blue is expensive and white perishable, apart from which it would imply a lack of originality in southern latitudes were the railway to have recourse to the one-time livery of the Caledonian. It seems to us that the Southern could most fittingly bear out its slogan of " South for Sunshine " by reviving the yellow paint which formerly adorned the locomotives of the L.B.S.C.R. A further touch of solar verisimilitude is proposed by a correspondent of ours in the shape of a rising sun device in scarlet and gold on tenders and side tanks between the words " Southern " and " Railway." Mr. Holland-Martin has so far not committed himself beyond saying that a brighter green for the engines may be considered. Whatever the outcome, this solicitude for the appearance of locomotives and trains indicates that the railway is accepted as an integral part of the national landscape.

* * * *

Reflections in a Waiting Room

During a recent period of incarceration in a waiting room north of the Border, we noticed the attempt made to impart a cheerful appearance to the walls by adorning them with brightly coloured impressions of seaside resorts. Yet so strong was the contrast between the lively pictures and the austerity of the bare boards on which they hung, that when a porter who entered to make up the fire discovered us studying a view of Clacton, we felt somewhat in the position of a monastic novice whose Abbot catches him in the act of reading *Sporting Life*. The cell-like atmosphere of the place was emphasised by the fact that the window was well above the average line of sight, while the passage of time, which is after all the chief interest of those assembled in waiting rooms, could be confirmed only by a considerable journey down the platform. Such experiences increase our pleasure at Mr. Holland-Martin's suggestion at the recent Southern Railway meeting that the company hoped to make its waiting rooms places from which passengers would tear themselves with regret to enter the importunate train. The task in the South no less than in Scotland involves more radical changes than the introduction of new furniture and mural decorations.

* * * *

Moroccan Railways Results

Developed from an extensive system of 60-cm. military lines, the Moroccan Railways, described on page 438, now extend to a length of 634 miles of standard gauge route with another 50 miles in course of construction.

In addition, there are still about 230 miles of narrow-gauge lines in operation. Over the whole course of 1933 there were 360 route miles of standard-gauge lines worked, and partial operation was in force over the Fez-Oujda line (opened in May, 1934) and from Ben Guerir to Louis Gentil. The total receipts from the above 360 miles amounted to 69,055,842 fr. (8 per cent. more than in 1932), and as the working expenditure totalled 57,338,232 fr. the operating ratio was 83. The capital charges amounted to 10,208,124 fr., leaving a surplus of 1,509,486 fr. after all accounts had been met. The passenger and *grande vitesse* receipts were 13,992,641 fr., and the goods revenue 50,333,997 fr., of which 20,769,836 fr. came from the phosphate traffic. The number of passengers carried was 1,365,694, including 936,265 native fourth class. Passenger trains covered 1,174,053 km., of which 806,580 km. were run by electrically-hauled trains; the corresponding figures for goods trains were 1,020,798 and 589,172 km. The lesser mileage for greater receipts of the goods trains is due mainly to the large phosphate tonnage (1,105,532 tonnes) brought down to Casablanca from the Kourigha district, 140 km. The surplus obtained on the 360 miles of fully-opened lines was more than offset by the loss on the partially-opened divisions, for which the receipts were only 5,124,809 fr. compared with an expenditure of 17,519,404 fr., but as the Fez-Oujda line is now opened throughout to local and international traffic it is probable that at least an operating profit will be shown in the accounts of 1934.

* * * *

A Short Way with Road Competitors

Advocates of action rather than arbitration as a means of settling disputes will applaud a recent dramatic *coup* brought off by the Netherlands Government against road competitors with the railways. On an appointed date, it is reported, mobile police stationed themselves near the railway viaduct at Wassenaar, on the outskirts of The Hague, and held up all " pirate " buses on the services from Amsterdam and Rotterdam. Passengers were obliged to continue their journeys by train, for the captured vehicles were first confined by the police in neighbouring garages, but later, in response to the prayers of their broken-hearted owners, were allowed to return home on the harsh condition that they stayed there. Attempts to enter the city at other points were similarly frustrated, and although certain contractors hired taxies to convey their passengers, the device was soon discovered. The authorities were stated to have declared their intention of continuing this procedure until the bus owners agreed to withdraw their services, assuming a faint-heartedness on the part of the " pirates " which was indignantly repudiated. While each party was thus crying " havoc!" to the other, taxi-drivers displayed that opportunism which is their international characteristic by reaping a rich harvest from stranded passengers.

* * * *

L.M.S.R. Quota Results in 1934

Although passenger traffic on the L.M.S.R. last year failed to reach the quota by the narrow margin of 1·07 per cent., all districts showed increases in the value of business handled. The greatest advance was made by Belfast, amounting to 14 per cent. and sufficing to retain for this town its position at the head of the table. Chester is second with an increase of 11 per cent. and Sheffield and London, occupying third and fourth places, are to be congratulated on their recoveries from eleventh and twelfth respectively. The three leaders in the table all exceeded their quotas. The fact that an increase in business of £2,904 did not save Stoke from falling from first place among the English districts to eleventh, shows what a high standard of achievement has resulted from the quota scheme. Referring to our editorial remarks on travel in the Jubilee year in THE RAILWAY GAZETTE of December 14, *Quota News* expresses the determination of the L.M.S. to secure a large share of the traffic so accruing, a hope to which the foregoing figures give a good chance of realisation. Twenty districts improved their freight traffic in 1934 and five exceeded their quota. Wolverhampton leads with 105·51 per cent., followed by Goole (104·62 per cent.), which has come up from twenty-second place in 1933. Altogether, 95·84 per cent. of quota was attained.

* * * *

The Distant Signal in Switzerland

As reported in our Overseas columns this week, the Swiss Federal Railways have decided to alter their distant signals to conform with the principles now prevailing in most countries and which prescribe yellow lights for cautionary indications and green for clear. The development of the distant signal in Switzerland is interesting. It was really derived from the original German one. In Germany the green light was adopted for the proceed aspect in all stop signals on January 1, 1893, except in Bavaria, where the white light survived until after the war. The distant signal, a green disc mounted on a short post, continued to exhibit a green light for caution and white for clear until 1910, when it was decided to adopt the plan tried from 1901 onwards in Saxony at the suggestion of Professor Ulbricht, namely, a double yellow and double green for these indications. Nine years were allowed for the change in all signals, except, as stated, in Bavaria, where also the new night aspects were eventually adopted. In Switzerland, owing to the influence of German signalling firms who had branch establishments in that country, stop signals of the German semaphore type were used. The distant disc, however, was modified in order to make the use of the green light for caution as safe as possible, the introduction of a third colour being then considered impracticable. By means of a reflecting lantern two green lights were shown, side by side, as seen on page 269 of our issue for February 16, 1934, the lights turning white when the signal was cleared. The disc was painted green, but will be yellow in future.

* * * *

American Rolling Stock Orders

Both passenger and freight rolling stock orders placed by the American railways during 1934 showed a decided turn for the better compared with the depression years 1931 to 1933 inclusive. Tables in the Annual Statistical Number of our American contemporary, the *Railway Age*, show that the figures in both cases succeeded low records in 1933, while the number of passenger vehicles ordered for domestic use, rising from 6 to 388, exceeded by 332 the combined totals of the three preceding years. There have, however, been no orders from Canada since 1931. It is also recorded that 2,500 air-conditioned cars, of which 1,878 were equipped during 1934, were running at the end of the year. The total of 24,611 freight cars ordered for domestic use last year was nearly seven times the combined business of 1932 and 1933 and 10,000 in advance of the total for 1931 to 1933 inclusive. There have, however, been only five other years, of which 1931-33 contribute three, since the beginning of the century in which fewer than 25,000 cars have been ordered. Peaks of 341,315 freight car orders in 1905 and of 4,514 for passenger vehicles in 1909, place the latest figures in their true perspective.

XUM

Speed

MANY records were broken on the remarkable test run of the London & North Eastern Railway from King's Cross to Newcastle and back on Tuesday last. Among them the most spectacular, of course, was the maximum speed of 108 m.p.h. reached between Little Bytham and Essendine, which formed part of a stretch of over 12 miles covered at an average of 100·6 m.p.h. Little less remarkable, probably, was the mean speed of 76·4 m.p.h. maintained for 13 miles in the opposite direction up the same grade, with a train of 213 tons weight behind the tender. Such feats were, however, incidental to the main feature of the test, which was that one standard express locomotive, seven years of age and already with 392,853 miles of running to its credit, proved capable of covering 536½ miles, in one single round trip within an overall time of 10½ hr., at an average speed of just over 70 m.p.h. throughout. Moreover this average included eight or nine very severe service slowings for curves, and not a few others of lesser severity. Nothing approaching such figures has ever been known before in steam locomotive history, and the facts pay a remarkable tribute to the excellence of British materials and workmanship, no less than they do to the high level of L.N.E.R. locomotive design and maintenance. Credit must also be given to the design and maintenance of the carriages and the permanent way, for the running was as smooth as that of any ordinary train, and at the very highest speeds it seemed distinctly smoother.

Normally the best time of the day between Newcastle and London is made by the up Flying Scotsman, which is allowed 5 hr. 6 min., inclusive of stops at Darlington, York, and Grantham totalling 9 min. With a little less than one-half the average load of this famous train, and no stops, the 4-6-2 engine No. 2750 *Papyrus* cut 74 min. from the Flying Scotsman's timing. Furthermore, the time to Newcastle was 26 min. less than the best of the times achieved in the historic Race to Aberdeen of 1895, with roughly twice the load, and one engine throughout instead of the three used over the three successive stages of the run of forty years ago. Another impressive demonstration was thus afforded as to the possibilities offered by existing British locomotive stock, without any special preparation, to give service comparable with that entrusted to diesel railcar units abroad. The six-coach train used on Tuesday last contained 204 first-class seats and full restaurant car accommodation; and so far from the provisional 4-hr. schedule in both directions proving a tax on the powers of the locomotive, it was clear that the engine was being eased at various points, in order to avoid running ahead of time. Allowing for an out-of-course check at Arksey, the down journey was completed in 10 min. less than schedule, and the up in about 13 min. less.

The engine used on this occasion showed an appreciably higher maximum speed capacity than the one which figured in the previous high speed test to and from Leeds on November 30. *Papyrus* works at 220 lb. per sq. in. pressure as against the 180 lb. of *Flying Scotsman*, and has three 19 in. by 26 in. cylinders as compared with the latter's 20 in. cylinders. The subdued sound of the former's exhaust, as compared with the latter's, also witnessed to easier working and lower coal consumption on the part of the high pressure engine. The highest speeds were also reached, as might be expected, when *Papyrus* was being driven with regulator wide open, and was cutting off relatively early in the stroke. What might have been achieved in the way of speed with such special preparations as streamlining, roller bearings for engine and coaches, and modern French front-end design, such as has been applied to the new L.N.E.R. 2-8-2 locomotive *Cock o' the North*, staggers the imagination.

* * * *

Reich Absorption of the Saar Railways

WITH the transfer of the Saar territory to the German Reich on March 1 in conformity with the plebiscite held at the beginning of the year, the railways there became part of the German State Railway system. The issue of the plebiscite had never been in doubt for Germans themselves and accordingly many of the arrangements necessitated by the transfer had been planned in anticipation some time before. No sooner was the result of the voting, with its overwhelming majority in favour of a return to Germany, made public, than the General Management of the Reichsbahn in Berlin exchanged telegrams full of enthusiasm and attachment with the Saar railway officials, welcoming the incorporation of the lines, which had for fifteen years formed a separate operating unit under neutral administration, into the great German national railway system, whose creation as one unified concern was actually posterior to the constitution of the Saar administration. The latter was set up on January 10, 1920, and it was not until April 1 of that year that the various State railway systems of Germany were officially amalgamated to form the Reichsbahn. The Saar lines were formed out of both Prussian and Bavarian lines. There had for a long time been a Divisional Management, or *Direktion*, of the Prussian State Railways at Saarbrücken and this was moved to Trier, leaving Saarbrücken as headquarters of the Saar system only, which comprised 407 km. of lines, of which 95 were light railways, or *Nebenbahnen*. By an order made by the General Manager of the Reichsbahn, Dr. Dorpmüller, on February 2, the management at Trier has been dissolved as from March 1 and Saarbrücken has resumed its former place, but certain administrative work for the Reichsbahn is to be centred at Trier in order to afford that town some compensation for the change.

About 90 km. of the lines in the late Saar Territory originally belonged to the old Bavarian administration at Ludwigshafen, but they will still remain attached to Saarbrücken, as the fifteen years of unified operation have created a situation which it seems undesirable to disturb. There were also 40 km. of route worked by the Alsace-Lorraine Railways Administration, and these France laid claim to and worked until March 1. Germany had claimed all along that they should come under the Saar management and an agreement was reached at Rome whereby they have been included in the mines purchase arrangements so that they now form part of the Reichsbahn. The territory covered by the new Saarbrücken management covers over 1,500 km. of lines, extending to Coblenz on the north-east, Losheim on the west, and Bad Kreuznach on the east. It has many points of contact with neighbouring territories. There are two routes into Belgium, 1 into Luxemburg, and 7 into France. The customs arrangements are dealt with in every case separately on either side of the frontier and there is as yet no common customs station serving two administrations. This may, however, be changed in time. The accommodation is not adequate at some places and new stations will have to be constructed. It is intended to retain the management of the workshops at Saarbrücken for the time being, as was done at Königsberg, rather than bring it into the main central workshop management, due to the special circumstances of the case.

The economic significance of the Saar district is very

great, accounting as it does for 9 per cent. of the coal, 8 per cent. of the coke, 12·4 per cent. of the benzol, and 25 per cent. of the iron produced in Germany. The customs union with France, now terminated, naturally affected the trade channels of the territory and some re-adjustment will have to be made. It is intended to do everything to lessen such hardship as may be felt in this respect and the Reichsbahn has, it may be noted, appointed a special officer to study how local manufacturers and industries may be helped by the placing of orders with them. The trade agreement now being negotiated with France will, it is hoped, also have a beneficial effect in these matters. There is much work to do on the railways. The goods stock has not yet been fitted with continuous brakes, for instance, and signalling and station equipment requires revision and improvement. The railways are, however, able to carry the traffic and are fortunate in not having much canal competition to meet. There is canal communication with France on the east for vessels up to 200 tonnes capacity and to the Rhine, via the Saar river and Rhine-Marne Canal through Strasbourg, for vessels of 300 tonnes. A certain amount of new railway construction is in hand, including the Oster Valley line. New timetables are to be introduced as rapidly as circumstances permit. The disappearance of the customs barrier between the Saar and the rest of Germany has enabled stops to be eliminated with an average saving of 15 to 20 minutes a train. Much faster connections to the Ruhr, Rhine and Main districts are to be given and the journey time to Berlin is to be reduced from 13 to 10 or 11 hours. The standard Reichsbahn rules and regulations can be introduced only gradually, and it is not intended to hurry anything of this kind unduly. Such a time of transition must necessarily be marked by many difficulties, but, to judge from the spirit exhibited by the staff, as reflected in *Die Reichsbahn* and other German journals, there is no want of resolution in meeting them and there seems little doubt that the Saar lines will soon be working most efficiently in association with the rest of Germany's great national railway system.

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The Port Eglinton Junction Accident Report

IT was a matter for much satisfaction that Colonel Trench's report on the Winwick Junction collision of September 28 last, which was reviewed in our issue of January 11, revealed no method of operation or detail of signalling equipment that could be criticised. It is true that track circuit in the rear of the down fast home signals and suitable interlocking with the block instrument would have avoided the collision, but Winwick Junction was on a list of places to have that equipment, and it would have been installed after places that needed it more had been provided for. The same favourable comments cannot, however, be made regarding Port Eglinton Junction where, on September 6, occurred the collision as to which Colonel Mount's report is reviewed on page 468 herein. Whilst it is almost certain that this unfortunate occurrence was caused by Driver Kerr of the train from Paisley over-running his signals, it is positive that his irregularity would have had no ill-effect at all had junction working been in operation. Actually, junction working was definitely laid down, but for thirty years the signalmen have taken the wording " When the . . . line is clear to this box " to mean the area covered by the junction signals. Thus, although the Paisley train had been accepted, the Kilmarnock train had the points set and its signals put to " clear " to cross from the up main, across the down Canal line—whereon the Paisley train was approaching—on to the up Canal line, with only the down Canal home signals, 147 yd. from the diamond crossing of the two lines, between it and the Paisley train. There was a third train—one from Ardrossan—which, whilst it does not enter into this question of junction working—although, as will be seen in a moment, it was the indirect cause of the accident—it is necessary to mention in order to quote the following remarks of Colonel Mount summing up what junction working is intended to effect:—

> The procedure they (the signalmen) should have followed is clear. They had accepted three trains and all were in section and approaching the junction at the same time; as the Paisley train was the first to be dealt with, and was routed along the Canal line—a continuation of the line on which it approached the junction—the points—in the up main line—should have been left normal for the Kilmarnock train, just as they were locked normal for the Paisley and Ardrossan trains after acceptance of the latter. All three trains would then have approached the junction safely, and the Kilmarnock train should not have been permitted to cross the path of the Paisley train until the latter had come to a stand.

Colonel Mount adds at this point that immediately after his inquiry arrangements were made to apply standard instructions for junction block working. He was also informed that an investigation into the methods of operation at all junctions in Scotland would be put in hand with a view to uniformity.

The description given by Colonel Mount of the running view of the signals approaching Port Eglinton Junction from the Paisley direction makes remarkable reading. It is, however, just what we noticed when we visited Shield's Road after the accident. The down main line signals are very pronounced; the down Canal signals are low in comparison and they are not very readily distinguishable on approach. The heavy reverse curvature had some peculiar results in that the driver of the Paisley train saw the down main line signals on his right and those for the down Canal line were on his left, whereas that was the reverse of the way the lines are laid—the main lines are to the left of the Canal lines. Another remarkable feature was that for 152 yd. the line of vision of the Canal line signals was obstructed by two boards, used in connection with Rule 55, on a bracket post carrying two up line signals. The driver, who has had 30 years' service, for the last 14 of which he has acted as driver, is spoken of as a good engineman, with an excellent record. He said that he had a good working knowledge of the signals and knew that, with the curves, the relative view varies. His evidence, which, Colonel Mount remarks, was obviously given with sincerity, was that when he first saw the Canal line home signal it was at " clear." His engine was running tender first so, in order to ascend the 1 in 86 into Cumberland Street station, he had to turn round to open the second regulator valve and to notch up the engine and, when he again looked at the signal it was, he claimed, at " danger." The report shows how unlikely it is that the signals were restored, the junction altered and the signals lowered for the Kilmarnock train in the time—less than a minute—that he urged. We referred above to a train from Ardrossan. For that the down main signal was at " clear " and Colonel Mount's opinion is that Kerr " was over-confident with regard to his knowledge of the positions of the signals concerned and that when they came in view for the first time, with the down main line homes on the right, as already described, he jumped to the conclusion that No. 65—the down main home—which was at ' clear,' applied to his movements."

We reproduce in our summary the complimentary remarks contained in the concluding part of the report, and there remains only one other matter to mention. It relates to a subject that has not figured in our accident report since a buffer stop collision at Euston in 1928—the duties of guards when approaching terminal stations and important junction points. The guard of the Paisley

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train, in his evidence, said that he was riding in the brake compartment of a third-brake, but he was not looking out as he was standing at the table tying up letters which had been handed to him at the station previous to Shield's Road. Colonel Mount's opinion of the guard's duty at that moment is reproduced in our summary, and we need only emphasise his remark that " it seems questionable whether guards, particularly of suburban passenger trains, should be permitted to allow anything to deflect them from the duty of observing signals when approaching junctions and terminals."

* * * *

Italian State Railways in 1933-34

ON June 30, 1934, at the close of the financial year 1933-34, the total route length of line worked by the Italian State Railways was 17,007 km. or 10,544 miles, a net increase of 79 km. (49 miles) as compared with the preceding year. This was accounted for by the opening of the Bologna-Florence Direttissima, the Fossano-Mondovi-Ceva and Piacenza-Castelvetro lines and a few short junction connections, the additions totalling 162 km. (100 miles); while on the other hand 83 km. (51 miles) of line were handed over by the State to a private company. Of the 17,007 km. total length, 16,231 km. (10,063 miles) were of standard and 776 km. (481 miles) of narrow gauge. The total route length electrified was 2,182 km. (1,329 miles), excluding the Domodossola-Iselle line, which is worked by the Swiss Federal Railways, and the aggregate of double line was 4,341 km. (2,691 miles).

The financial position on June 30 last showed a deficit for 1933-34 of approximately £13,450,000,* total receipts amounting to £49,126,000 (– £3,289,000)† and total expenditure to £62,575,000 (– £105,000). Traffic receipts totalled £45,766,414 (– £3,987,661), this decrease being accounted for mainly by a fall of £3,140,860 in goods receipts, due to acute road competition. The total figure of traffic receipts works out at £2,708 for each kilometre of line worked or 7s. 1d. a train-kilometre. On the debit side of the account, the net reduction of expenditure by – £105,000, was accounted for as follows:—

(1) Lower costs of (*a*) salaries and wages—£685,000; (*b*) fuel, thanks to a fall in average price from 33s. 7d. to 29s. 4d. a ton—£282,000; (*c*) maintenance of rolling stock—£476,000; (*d*) prevention and repair works against damages caused by *force majeure*—£517,000; and (*e*) improvements of way and works—£517,000.

(2) On the other hand, accessory expenditure rose by as much as £1,655,000, due to higher Treasury interest charges and to £1,283,000 amortisation on the £20,000,000 loan floated for railway electrification.

The total number of employees of all grades was 136,047 (– 2,811) or 7·81 a km. of line worked. No fewer than 195 level crossings were replaced by over or under bridges, and increased speeds necessitated a higher standard of permanent way maintenance, including an addition of 1,700,000 cu. yd. of ballast; 420 miles of track were relaid. Experiments with welded rail joints have given good results: the standard length of welded rail is 36 m. (118 ft.). General improvements included new signalling and telephone installations costing £780,000 and £600,000 respectively. There were in service 4,930 steam (– 157) and 955 electric (+ 2) locomotives and railcars, 79 (+ 69) internal-combustion engined railcars. Passenger coaches totalled 7,483 (– 580), luggage and mail vans 4,600 (– 72) and goods vehicles 132,883 (– 7,967). The daily average numbers of locomotives under repair were: steam 446 or 8·9 per cent., and electric 91 or 9·8 per cent. Six train ferryboats were maintained in service across the Straits of Messina and 4,907 double crossings were made, carrying altogether 133,312 wagons and 12,265 coaches during the year. Loss of life due to accidents of all kinds among passengers and employees totalled 203 and 209 respectively, from all causes, but of these only 14 and 13 deaths were due to train accidents. The first of these figures is equivalent to 0·24 deaths for each million passenger journeys, or 0·02 for each 100,000 passenger train-kilometres, remarkably low figures testifying to the safety of the whole system. It is estimated that 20 per cent. of the traffic was lost to road competition, representing a loss of nearly £9,000,000 (+ 7 per cent.). Due to reduction of tariffs, some 6,000,000 tons of goods, which would otherwise have gone by road, were recaptured by the railways. Competitive rate cutting and cut-throat competition between individual transport contractors have resulted in such low rates that there is now often no profit to be made at all by the road hauliers.

* To simplify reading, figures are given in £ sterling, £1 being taken as equal to 60 lire, the average rate during the year.

† Figures in brackets preceded by + or – signs, indicate the increase or decrease respectively as compared with the corresponding figures in 1932-33.

LETTERS TO THE EDITOR

(*The Editor is not responsible for the opinions of correspondents*)

Track Recording on the G.W.R.

The Chine, 8, Burnt Ash Lane,
Sundridge Park, Bromley, Kent.
February 25

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I noticed in the issue of THE RAILWAY GAZETTE for February 15 that the Great Western Railway uses an apparatus which deposits whitewash on the track to mark track depressions. This seems to me quite a good idea, but I was surprised to read that the apparatus was fitted to a bogie coach; surely it should be fitted to the heaviest of rolling stock, the locomotive.

My memory carried me back to my RAILWAY GAZETTE file, and after a few minutes' search I found my objective—your issue of April 20, 1934—in which an apparatus is mentioned " Recording of Track Alignment Defects " for fitting to a locomotive. It seems to me that track alignment testing employing the weight of the locomotive is the logical way, as track deviation affording safe running to the locomotive would be equally safe for the coach, but the reverse performance would not necessarily prove the same.

Yours faithfully,
A. J. CEE

Mechanics of a Locomotive on Curved Track

36, Wilton Crescent, S.W.
March 2

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—My objection with regard to the slide-bar pressure would probably not have been made if I had waited to study the articles carefully as a whole.

But with regard to air resistance (which I think was the term I used, not wind resistance—I am away from home—), I do not agree as to the complication. Actual conditions would have been approached more closely, if a figure had been taken for the air pressure in a cabin. No varying factors need have been introduced, nor considerations of side pressure.

Yours truly,
C. F. DENDY MARSHALL

PUBLICATIONS RECEIVED

Fishing in the South. By J. W. G. Tomkin. London: Published by the Southern Railway Company. 8½ in. × 5½ in. 208 pp. Price 2s. 6d.—A notable feature of this interesting little work is a folding and specially-drawn map of the South of England showing the principal fishing centres and the railway stations which serve them. This map, which includes a separate view of the Thames, is divided into sections—in keeping with the plan adopted by the compiler, who, we note, expresses the hope that it may be possible to produce further editions of the guide from time to time, "each more informative than the last." As to that, the seasoned angler will doubtless agree that an excellent start has been made, most of the places named in the guide having been visited last year by Mr. Tomkin, who took with him on all these trips rods of one sort or another in order that he might be able to describe conditions and sport from actual and recent fishing experience. The result is that not only is the information thoroughly up to date, but it is also of the greatest value to the angling fraternity, packed as it is with hints about bait and tackle, local accommodation and charges, &c., to the happy accompaniment of much shrewd comment and observation. The guide, which is nicely illustrated, opens with three most interesting articles on coarse, fly, and sea fishing, in that order, the first by Mr. E. Marshall-Hardy, the second by Mr. Tomkin himself, and the third by Mr. Arthur F. Bell.

On Schedule. By E. Laurie Long. London: Ward, Lock & Co. Ltd. 7½ in. ×5 in. × 1½ in. 320 pp. Price 7s. 6d. net. —Although the publishers class "its unusual background of railway life" as one of the merits of this book worthy to be extolled on the jacket, readers brought into daily contact with scenes corresponding to those described need have no fear that familiarity will impair their appreciation of the story's atmosphere. For Mr. Long's is an unusual railway, and acquaintance therewith is enlivened by the surprises it brings. We can excuse the author for his frequent half truths and inaccuracies by acknowledging the application with which he has acquired a copious vocabulary relating to an intricate subject, but when his railwaymen begin to talk in technical parables, we feel that he commits an unwarranted trespass upon our ability as interpreters. "Bill drives on the starter, I on the distant," is too obscure a metaphor to be welcomed in a piece of light fiction. The dialogue throughout is loaded with jargon of this sort, and the result is about as convincing as would be that of a public school story in which the characters were continually exhorting each other to "play the game."

Considered as a contribution to the literature of railways, therefore, "On Schedule" suffers from its superficiality. A much more authentic atmosphere has been created by authors content to write from the viewpoint of the passenger. But as a story, we find nothing to cavil at in this straightforward narrative of a young driver who rescues a squire's daughter in a railway accident and eventually makes her his bride. And when we add that the villain is a Mr. Daston, we prepare prospective readers for all the ingredients of melodrama.

The characterisation is in the grand manner. The hero is endowed with superhuman qualities, for at one point he is made to raise steam from 80 lb. to 180 lb. per sq. in. in three minutes with no more than a touch of the pricker, despite a grate full of clinker. Again, he fires a 0-6-0 goods engine to such good purpose that it saves two minutes with the Night Continental on a 60 m.p.h. schedule. But this, of course, surprises us less when we learn that he is used to handling 400-ton express goods trains with a 4-4-0. At 21, after six years' service, he is rewarded for his herculean labours by becoming a passed driver.

Railway officers are not neglected in the story. We find locomotive men responsible to the Chief Engineer, and this official has designed an engine of such awful complexity that the normal man cannot learn to drive it in under a week. We should like, however, to have been introduced to the functionary who decreed that the engine sheds should be situated 40 miles from the terminus, or to the builders of the shunting engine in which notching up was replaced by the mysterious process of "nipping up the lead."

Hutchinson's Technical and Scientific Encyclopædia: Vol. I. Edited by C. F. Tweney and I. P. Shirshov. London: Hutchinson & Co. (Publishers) Ltd., 34, Paternoster Row, E.C.4. 9¾ in. × 7 in. × 2 in. 672 pp. Price 28s. a single volume; complete in 3 volumes, Four Guineas.—The preface to the first volume of this work points out that the term "encyclopædia" has been applied to it chiefly because of the alphabetical arrangement of subjects. The articles are, in fact, distinguished by a more practical approach than is usually expected in books of reference, and their length is such as to allow of commendably lucid treatment. As the present volume terminates with "direction finding," we are unable to review the treatment accorded to the transport medium in which we are most interested, but if it is proportionately as extensive as the pages devoted to aeronautics, aeroplanes, and airships it will be a valuable section. The articles on many subjects, if pursued throughout all their alphabetical ramifications in the various volumes, are almost of book length, but for the benefit of those who desire a more specialised treatment than can be given in a general work there is a bibliography listing 3,000 volumes at the end of the encyclopædia. In addition to the more lengthy articles, definitions are given of engineering and scientific terms, and there is an abundance of useful formulæ, data, and tables.

Illustrations, both half-tone and line, are numerous, and possess a merit sometimes absent from scientific works for general consumption in that they are up to date. The encyclopædia is described as the only one of its kind to be published during the past quarter of a century. By assembling so much material, for which recourse would otherwise be necessary to specialised libraries, it should do much to promote a more liberal scientific education in future among all who come in contact with the technical departments of modern industry and enterprise.

N.U.S. Travel Publications.—The February issue of *The New University*, the organ of the National Union of Students, is a travel number, designed to promote interest in the possibilities of holidays on the Continent. The union specialises in the organisation of cheap tours abroad for students, and its reputation in this respect permits us to overlook a somewhat virulent editorial which scourges the "descendants of a nation of sea-rovers" who have "lapsed into a comfortable conservatism which expounds the short-sighted policy of 'See England First,' and settles down to parochial potterings over the fields and hillocks which we try to elevate to the status of mountains." Groaning at the insufficiencies of his own country, the reader will, therefore, clutch avidly at another N.U.S. publication—"Easter Tours, 1935"—only to find that it opens with terms for walking tours in England and Scotland. There are also particulars of winter-sports holidays in Switzerland, Austria, and Poland, and of other excursions abroad at very reasonable rates.

Colloidal Graphite Applications. —We have received two issues of the *Technical Bulletin* published by E. G. Acheson Limited, manufacturers of colloidal graphite products. These bulletins provide periodical information regarding new applications for Acheson colloidal graphite, and one of those under review, No. 191, deals particularly with the use of Aquadag brand colloidal-graphited water as a ray-focussing anode material for the cathode ray tubes used in television oscillographs, a duty which suggests the possibility of many uses in the field of applied electronics. The other bulletin, No. 230.1, gives a general survey of the properties of colloidal graphite and the forms in which it is available. As well as being extensively used as an anti-friction body in all types of machinery it is suitable as a lubricant in the drawing and extruding of metals and as a resistance material in electrical work.

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THE SCRAP HEAP

An odd difference in railway travelling is that now, in any class, one is rarely either entertained or plagued by children. One has only to look at back numbers of *Punch* to realise how largely badly managed children made a misery of cheap railway travelling. Now there are proportionately fewer children, and most of these are transported by car. One hears of boys and girls of school age being given their first railway journeys as a treat.—*From "The Lady."*

* * *

If you doubt that England has such descriptive names, consider the great Truth that at one junction on a railway where a mournful desolation of stagnant waters and tree-less stone-walled fields threatens you with experience and awe, a melancholy porter is told off to put his head into your carriage and to chant like Charon, "Change here for Ashton under the Wood, Moreton in the Marsh, Bourton on the Water, and Stow on the Wold."—*From "The Path to Rome," Hilaire Belloc*

* * *

TICKET REDEMPTION AFTER 64 YEARS

The Southern Pacific Railroad (U.S.A.) recently made refund of $1 on a ticket, and believes that it thereby set a record for the length of time elapsing between the purchase of the ticket and its redemption. This particular ticket was bought more than 64 years ago by Mr. Frank Elder, 79-year-old pioneer resident of Lincoln, Cal., who kept it and finally offered it for refund only as an oddity. The ticket, which covered transport from Rocklin, Cal., to Lincoln, a distance of 14 miles, was purchased on July 10, 1870, from the Central Pacific Railroad, now a part of the Southern Pacific system.

* * *

ONE PASSENGER TO ANOTHER

A. (heatedly): "I dare you to put that window up at your peril."

B. (equally heated): "And I dare you to leave it down at *your* peril."

Porter (opening door): "Orl change. This don't go n' further."

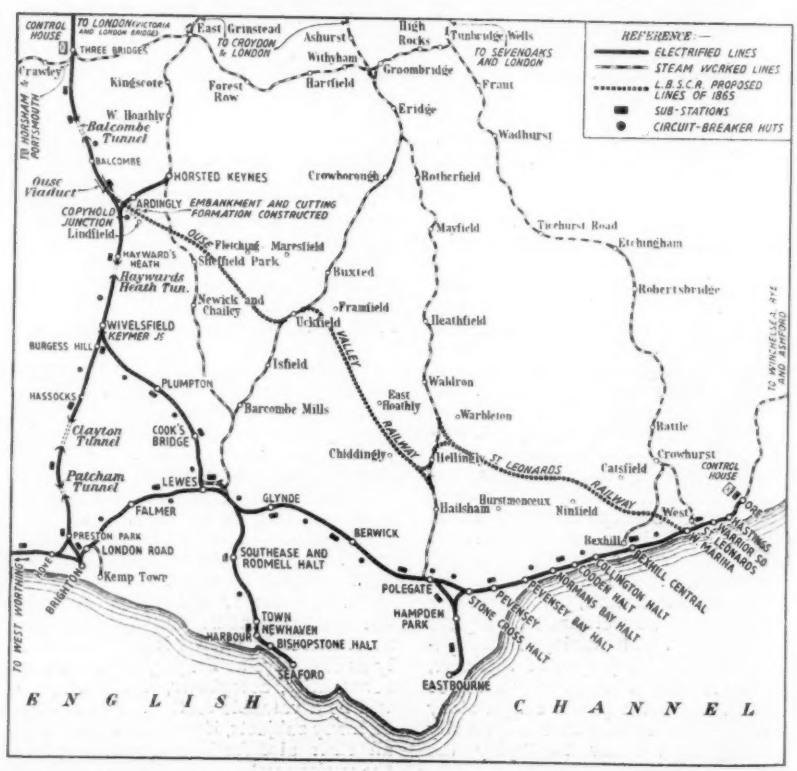
* * *

The impending opening of electric traction to Hastings on the Central Section lines of the Southern Railway gives topical interest to the accompanying picture which we reproduce from a photograph sent by a correspondent. It shows bridge No. 109 on the Brighton main line immediately south of the Ouse Viaduct, and, in front, the extended abutments on the down side of the bridge. These unfinished abutments are one of the few physical reminders of a series of schemes which would have resulted in the building of a new cross-country route to Hastings via Uckfield and Hellingly.

The Ouse Valley Railway, authorised by the L.B. & S.C.R. (Ouse Valley Line) Act of June 23, 1864, was to have run from a point on the Brighton main line just south of the Ouse Viaduct to Uckfield and Hailsham. An Act of May 26, 1865, sanctioned the St. Leonards Railway and also various deviations in the Ouse Valley line. Actually the abutments illustrated were on one of these deviations.

About this period the L.B. & S.C.R. was passing through a period of financial difficulty and the shareholders made it clear that they did not approve of new construction—in fact "close the capital account" was a persistent and popular cry. Work on these schemes was therefore discontinued, and the lines were formally abandoned in 1868. Apart from the extended abutments to bridge No. 109, there are remains of the Ouse Valley line in derelict embankment and cutting formation near Lindfield, as indicated on the accompanying sketch map.

Bridge on Brighton main line with unfinished Ouse Valley abutments



Proposed L.B.S.C.R. lines of 1865 and sections now in course of electrification

OVERSEAS RAILWAY AFFAIRS

From our correspondents

VICTORIA

Increased Locomotive Efficiency

The Victorian Railways prepared plans in 1933 for increasing the thermal efficiency of their locomotives, based on theories advanced by their own and by German locomotive engineers. A 2-8-0 " C " class engine was first fitted with a self-cleaning smokebox and altered superheater elements, and other engines of the class were equipped with Rosebud table grates and Franklin Butterfly pneumatic firedoors.

But the most important modifications effected in these engines took the form of alterations to the front end,* comprising the lowering of the blast pipe, increasing its diameter and that of the chimney, abolishing the petticoat and increasing the diameter of the cylinder exhaust ports. Marked improvement in steaming and reduction in cylinder back pressure resulted. The diameter of the superheater elements was increased and their return loops shortened to reduce both resistance to the flow of steam and also drop in pressure between boiler and cylinders, the mean effective pressure thus being increased. More uniform evaporation also resulted from the steadier flow of hot gases through the flues and tubes, and these modifications secured a more stable condition in the boiler generally. The new chimneys fitted are 23 in. in diameter and 18 in. high and of the flower-pot type. Detail adjustments have been made from time to time as the result of dynamometer car trials, but already over half the 26 engines of the class have been modified.

" A2 " Class 4-6-0 Locomotive Alterations and Trials

The success of these modifications in the " C " class engine suggested similar experiments with the " A2 " 4-6-0 class of standard mixed traffic locomotive, and about 12 of this class have now been modified, some of them with a new stove pipe chimney. The " X " class (2-8-2) and " C " class locomotives are now nearly all fitted with Westinghouse cross compound air compressors for greater facility in braking increased loads. On one 2-8-2 engine, the left side big ends and journals are grease lubricated and the right is all red-oil lubricated.

That the " A2 " class as now modified is capable of excellent work is indicated by the results of a series of trials culminating in the following test run. Engine No. 998 covered the 100¾ miles from Bendigo to Melbourne in 130 min. at an average start to stop speed of 46½ m.p.h., with a load of 280 tons, in spite of the fact that, in the first 52 miles to Woodend, the line rises 1,083 ft. with a ruling gradient of 1 in 50, and that the maximum speed permissible is 60 m.p.h. The fastest trains previously in service over this section of line were allowed 3¼ hr., though one train a week in the opposite direction took 3 hr. 5 min. Subsequent to the trials, schedules have lately been improved over the western and northern systems, including one of 2½ hr. over this section with one intermediate stop. There has, in fact, been a speed-up of over 250 trains of all classes, and arrangements are being made for further accelerations in the near future on the eastern and south-eastern main lines.

* [These alterations were referred to in the Editorial on page 660 in THE RAILWAY GAZETTE of October 26 last.—ED. R.G.]

BELGIUM

Powerful New Pacifics

The first of the 15 Pacific (4-6-2) locomotives ordered by the Belgian National Railways has now left the works and is undergoing trials.

Nord-Midi Junction Line (Brussels)

As anticipated in the news columns on page 252 in THE RAILWAY GAZETTE of February 8, it is now stated that Senator Waucquez is laying before the House this week a bill providing for the immediate resumption of construction work upon this direct line between the two termini. The work, if sanctioned, would be undertaken by a private company similar to that which built the tunnel under the Scheldt at Antwerp, and the cost of construction would be borne entirely by that company without Government assistance. The outlay would be covered by a 15-centime tax on each passenger over the new line, and by the erection and letting of buildings in the immediate vicinity of the future central station in the " Putterie " district of Brussels, which station would deal with all through services. A saving of 2·5 miles will be effected on the journey from France to Holland as compared with the present circle route via Brussels Ouest.

SOUTH AFRICA

Imperial Press Conference

The members of the Imperial Press Conference now in South Africa will travel about 6,500 miles over the railways of the Union and Rhodesia. Two trains have been specially equipped for their accommodation. Each train consists of three articulated first class saloons, two of the latest type of first class saloon, a twin dining car, an observation saloon, a staff van and refrigerator truck. In certain saloons compartments have been converted into offices. An automatic telephone exchange has been installed in each train with telephones in the compartments. During the periods of stabling, connection will be established with the postal land line providing complete communication with the Union telephone systems. There is a radio-gramophone in each dining car. The visitors from overseas include forty-four delegates, thirty-four ladies and five servants.

The tour started on February 10 and the itinerary will include Kimberley, Mafeking, Bulawayo, Victoria Falls, Salisbury, Zimbabwe Ruins, Bulawayo, Johannesburg, Bloemfontein, Pietermaritzburg, Durban, East London, Port Elizabeth, Oudtshoorn, Knysna, Wilderness, George, and Worcester, concluding at Capetown on March 21.

ARGENTINA

B.A. Provincial Railway's Finances

The administration of the Buenos Aires Provincial Railway, a State-owned line which, despite its unfair policy of undercutting the private companies in the matter of rates, is in a chronic state of impecuniosity, has been authorised by the Provincial Government to draw on the revenue for the current year up to $300,000 paper wherewith to pay salaries and accounts pending since 1934, for lack of funds. The amount thus advanced is to be reimbursed later on out of the receipts. It is estimated that the earnings of the railway up to the end of the current financial year on February 28, will amount to $4,013,173 paper, whilst the liabilities are put at $4,307,983 paper, leaving a deficit of £294,810 paper.

The Labour Situation on the Railways

A preliminary meeting of the representatives of the Argentine railways and the unions was held on January 22, under the presidency of the Director-General of Railways (Señor Garcia Torre), to discuss proposals for the better utilisation of staff, as well as certain modifications in the present scale of salaries and wages (" escalafon ") as provided for in clause 8 of the Presidential award referred to in THE RAILWAY GAZETTE of January 4. The Director-General briefly explained the serious situation of the railways, pointing out its causes and effects. He also appealed to the men's representatives to view the problem in a clear light from the standpoint of the companies, in order to co-operate smoothly and effectively with them in their efforts to find a way out of the difficulties resulting from the economic crisis and competition from other forms of transport. The representatives of the companies and the unions assured the Director-General of their readiness to co-operate in a united effort to reach an agreement.

By the terms of the Presidential award, the National Railway Board, after consultation with the parties concerned, is required to submit within three months of the promulgation of the award the proposed modifications

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to the existing regulations. As, however, negotiations are expected to be somewhat protracted, the Government will be asked to extend this period by a further three months. Meetings were to be held every day, commencing on January 31.

Proposed Co-ordination of B.A. Street Transport Services

The text of the Bill for the co-ordination of the Buenos Aires street transport services mentioned in THE RAILWAY GAZETTE of October 26 last, has now been issued for publication. A majority report in favour of the measure has been signed by the Committee of Constitutional Affairs and Municipal Legislation of the Chamber of Deputies, although the Socialist members dissented *en bloc*.

The Bill provides for the creation of an entity to be known as the Corporación de Transportes de la Ciudad de Buenos Aires, formed by the co-ordination of the transport concerns in the city and suburbs, or by the fusion of all or any part of them under a single financial and technical management, while respecting the autonomy of such concerns as do not wish to be incorporated in the new combine. Railways under national jurisdiction and tourist services are excluded from the scope of the scheme, but their services may be co-ordinated by means of agreements in regard to such matters as fares, timetables, &c. Autonomous concerns which elect to remain outside the combine, will be subject to the same regulations as the rest, although retaining their individual internal organisation.

Powers of the Corporation

The Corporation will have exclusive control of all passenger services, and transport companies carrying passengers between the interior and the City of Buenos Aires may not land them within the city boundaries except by agreement with the Corporation, which will also have powers to approve or disallow new services. In the event of the Corporation declining to authorise any new services solicited, concessions may be granted by the Municipality, after consultation with the Control Committee, provided such concessions do not entail overlapping or unnecessary competition. The Corporation will be under the management of a board composed of representatives of the Government, the Municipality and the proprietors of the transport services This board will be under the control of a special committee of three members, two of whom will be nominated by the Government, with the approval of the Senate, and the other by the Municipality.

The new entity will be free from all taxation, and the national exchequer and the Municipality will be credited with a share in the capital equal to the taxes and other contributions which they do not collect; they will also receive shares up to an amount equal to the liabilities of the various transport companies in respect of taxes and contributions. The companies which desire to remain autonomous will be required to pay taxes as heretofore. The life of the Corporation has been fixed at 56 years, on the expiry of which the whole of the assets will be transferred to the Government or the Municipality, as the case may be, free of charge, except such property as may be purchased during the last 20 years of the concession, which will be paid for, after allowing for depreciation.

Committee to Organise Corporation

The organisation of the new entity will be entrusted to a committee comprising representatives of the Government, the Municipality and the existing transport concerns, the chairman of which will be nominated by the Government. Each of the companies will be represented on the committee in proportion to its size and importance. The committee's report, which must be ready within six months, is to include (*a*) the draft of the bye-laws of the Corporation, showing the amount of the capital and shares corresponding to the various parties, to be arrived at in accordance with instructions laid down in the Bill; (*b*) recommendations with respect to the suppression of some of the tramway lines in the centre of the City, and (*c*) the procedure to be followed in order to fix the scale of fares, which while being just and reasonable, must be sufficient to cover working expenses and the renewal of material, and also yield a profit not exceeding 7 per cent. As soon as the report has been approved, the Minister of the Interior will ask for its acceptance in writing from the various transport concerns. Omnibus and " micro-bus " lines which do not wish to join the combine may be expropriated.

BRAZIL

Government Order to Extend Barão de Mauá Station Rescinded

For some time doubt has existed as to whether the terms of the contract between the Government and the Leopoldina Railway oblige the latter to add a second wing to its main station in Rio in order to provide accommodation for the Linha Auxiliar and Rio d'Ouro narrow gauge lines of the Central Railway.

When Señhor José Americo d'Almeida was Minister of Transport, he tried unsuccessfully to compel the company to carry out this work, and at first the new Minister, Señhor Marques dos Reis, supported his predecessor. The company then again protested, appealing officially against the orders issued by Señhor José Americo, on the grounds that the latter had misinterpreted certain clauses in the contract, with the result that the present legal consultant to the Government decided that misinterpretation had indeed been placed upon those clauses by the late Minister.

Accordingly, the present Minister forwarded the consultant's report to the President of the Republic, stating that, in his opinion, the company could not rightfully be burdened with an onus which, at the time the original agreement between the Leopoldina and the Federal Government was signed, in 1924, it did not assume either expressly or implicitly. Moreover, considering that the company had been compelled to build a new station at additional expense to itself on the present site, there was no alternative but to agree to the consultant's findings, a course of action which he (the Minister) had no hesitation in recommending. On receipt of this report and endorsement from the Transport Minister, the President issued a dispatch allowing the company's appeal and waiving all fines which had been imposed through non-compliance with the ex-Minister's orders.

Train Control on Narrow Gauge Lines

To speed up traffic on the local section of the narrow gauge lines (Linha Auxiliar), selective train control apparatus has been installed at Alfredo Maia (terminus of the Linha Auxiliar) Francisco Sá (terminus of the old Rio d'Ouro line—now part of the Central Railway), Triagem, Del Castilho, Magno, Honorio Gurgel, Pavuna São Matheus, and Andrade Araujo. The control circuits are linked up to the head office in Dom Pedro II, with extensions to the Divisional Locomotive Superintendent's Office.

CHILE

Effects of the Strike

The State Railways strike [referred to in the Overseas columns of our issue of February 15—ED. *R.G.*] lasted barely 24 hours, and its effects were neither widespread nor serious. In view of this and the fact that no acts of violence or public disorder occurred, the Government ordered the 150 strikers who were arrested to be liberated as soon as the men returned to work. For a day or two, traffic working was somewhat disorganised between Santiago and Valparaiso, on which section a skeleton service was maintained with the assistance of the military authorities, but outside this zone the strike was not felt to any marked extent, and by the night of January 16 the State Railways administration was able to inform the Government that the service was again quite normal. The Chilean Transandine Railway was not affected. It is stated that the men's demands include the return of the wage reductions made during 1931 and 1932; an annual bonus amounting to at least 25 per cent. of the wages; and a general increase in pay to compensate for the higher cost of living. The State Railways administration states that it is impossible to grant these concessions until the

financial situation improves. According to the latest news from Valparaiso, the employees have presented a petition to President Alessandri, asking him to intervene on their behalf.

FRANCE

Government Revenues from Railways

Tax revenues drawn by the French Treasury from the railways to a large extent offset the current railway deficit, estimated for last year at about 4,000 million francs (£50,000,000 at 80 francs to the £). According to a recent statement by the Minister of Public Works, taxes and services rendered by the railways benefit the Government to the amount of 2,660 million francs (£33,250,000) annually. The taxes bring in 1,600 millions (£20,000,000), comprising 900 millions from passenger and goods taxes, 580 millions from taxes on railway securities and 120 millions from property taxes and customs duties on coal and other material used by the railways.

The Government also has the benefit of free railway services amounting to 900 millions (£11,250,000), comprising 720 millions for postal services, 150 millions for military transport and 30 millions for the inland revenue and customs services and conveyance of prisoners. Further, the railways bear transport charges on behalf of the Government for certain categories of passengers amounting to 160 millions (£2,000,000), comprising 60 millions for reductions allowed to large families, 50 millions for disabled veterans and 50 millions for cheap workmen's tickets. In addition, the country benefits by the ordinary taxes, business turnover tax, customs duties and other imposts paid by contractors and traders working for the railways. These receipts are estimated at more than 1,000 millions (£12,500,000), making a grand total of more than 3,660 millions (£45,750,000) derived from the railways.

Proposed Road Tunnel under Mont Blanc

Proposals for a road tunnel under Mont Blanc to provide a direct route for automobiles from Paris to Rome are now attracting attention in France. A bill to authorise the project was recently laid before the Chamber of Deputies. At present, travel by road between France and Italy is precarious during the winter. Virtually the only road always open is the one along the Riviera through Mentone and Ventimiglia, unless automobilists are prepared to support the heavy cost and delay involved in sending their cars by rail through the Simplon, St. Gothard or Mont Cenis tunnels.

Plans for the road tunnel, promoted by a Franco-Italian syndicate, have been drafted by M. Monod, a French engineer. The tunnel would give direct communication between Paris and Rome in almost a straight line. Entry to the tunnel would be near Chamonix and the exit near Courmayeur in Italy. Its length would be between seven and eight miles. Preliminary surveys indicate no insuperable difficulties in piercing the granitic mass of Mont Blanc. Reinforced concrete would be used as an interior facing for the tunnel and efficient lighting and ventilation are planned. Estimated cost is about 300 million francs (£3,750,000). Two separate tunnels for one-way traffic in each direction are proposed, but one might be used until the growth of traffic justified the piercing of a second. Traffic estimates indicate receipts amply sufficient to cover operating costs and a sinking fund for redemption of the capital outlay.

EGYPT

Auxiliary Railway Engines

The insistence of the State Railways Administration on the necessity for the acquisition of fifteen new locomotives for the Upper Egypt Auxiliary Railways has been successful. The Railway Board approved the purchase of ten engines in October last, but, the position being so acute, further application for the additional five was made, and this has now been granted. It is expected that tenders for these engines will shortly be invited. The locomotive position on these lines was reported in the issue of THE RAILWAY GAZETTE of November 2 last.

CANADA

Railway Communications with the Peace River District

The question of the provision of an outlet, in the form of a railway, for the produce of the 45 million acres of arable land in the Peace River district of North-West Canada has again been raised in the Dominion Parliament. The district which produces some of the best wheat in all Canada is at present without transport facilities except along its Eastern and Southern borders, and there is therefore a very legitimate demand for the early construction of a railway. Unfortunately, the cost of its construction is likely to be very heavy, and with finances in their present condition there does not appear to be much prospect of this line as a whole being constructed in the near future.

But there is, it seems, just a bare possibility that a start might soon be made in a comparatively small way, which would be developed gradually as funds became available. Several routes have been suggested for this important railway. One is as a branch of the Canadian National line to Prince Rupert on the West Coast. Another is as an extension of the Pacific Great Eastern, which also serves the Pacific coast to the north of Vancouver. The Minister of Railways agrees that the area must sooner or later be provided with railway communication, and there seems little doubt that every effort will be made to allot funds for construction at the earliest possible date.

MANCHUKUO

Hospital Trains

A hospital train is under construction in the South Manchuria Railway workshops, for service on the State Railway lines. This and a second train, which is to follow later, are to be sent out on tour at regular intervals to give the rural population medical aid where needed. The charges for this service will be nominal. The train will also be sent to regions where relief is needed from famines, flood disasters and other accidents. The train consists of three coaches, one equipped for the treatment of internal diseases, the second for external diseases, the third will be equipped as a surgery. The train is expected to be ready for service in April or May of this year, and will carry two doctors, nurses, a chemist and kitchen staff and helpers.

CHINA

Canton-Hankow Construction

Platelaying on the central portion of this construction work, between Shiuchow (or Lokchang), in northern Kwantung, and Chuchow, in eastern Hunan, is now expected to be completed before long, progress upon the intervening heavy engineering works, illustrated and described in THE RAILWAY GAZETTE of March 9 last, having been rapid and their completion well up to programme. The opening of this important through route should therefore take place in the not far distant future.

SWITZERLAND

Signalling Changes

Signalling on the Swiss Federal Railways is at present undergoing important alterations. Hitherto the distant signals showed, by day, a green disc with a white diagonal stripe, and by night two green lights for "caution" and two white lights for "clear." These lights were arranged in a horizontal line. As from February 1, the distant signals on the whole system were altered to show two orange lights for "caution." A period of one year will be allowed to elapse for the drivers to become accustomed to this alteration, after which the two white lights for "clear" will be replaced by two green lights, the old indication for "caution." Home signals will continue to show one red light for "danger" and one green light for "clear" or two green lights placed vertically when the points are set for a reduced speed route. The day aspect of distant signals is in future to be a yellow disc with a white stripe, but the change-over will be made gradually.

XUM

THE MECHANICS OF A LOCOMOTIVE ON CURVED TRACK—VIII

By the late S. R. M. PORTER, M.A., A.M.I.Mech.E., A.M.I.Loco.E.

Appendix VI.—Graphical method of calculation by trial and error, and example : Calculation of flange forces, &c., for a 4-6-0 tender locomotive, passing over a crossing on a 30½-chain curve

This example represents the conditions at a recent derailment,* where the leading coupled wheels of a 4-6-0 express locomotive, travelling at high speed, climbed the rails at a crossing on a curve ; fortunately, the bogie wheels kept to the rails, and the driver was able to pull the train up without accident.

Method of Calculation.—Make a preliminary drawing, using Roy's method, to see whether free or constrained curving is likely to be adopted. If the former, the three unknowns to be determined for a truck are : x, y (co-ordinates of the centre of friction), and Q (flange force at leading outer wheel). It will be found convenient to make an approximate determination of y the first step.

Set out the wheelbase of the truck in plan (Fig. 54) to a suitable scale (the " length " scale), the points of contact of wheel and rail being marked W. The centre line AB of the truck is drawn ; a second line is then drawn perpendicular

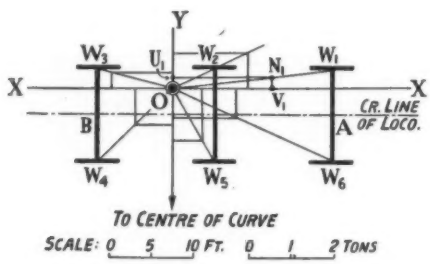


Fig. 54

to it, at any position that appears suitable to the draughtsman, and a point O is marked on it to represent the first trial for the position of the centre of friction. With O as origin, draw axes OX and OY longitudinally and transversely. Draw lines OW, joining the origin to the wheels ; along these, set off lengths ON from the origin O, to a second scale (the " force " scale) such that ON for each wheel represents the frictional force F between wheel tread and rail = μX wheel load. For each wheel, draw the ordinate NV from N on to the axis OX, to represent the longitudinal component of F ; and draw the abscissa NU from N on to the axis OY, to represent the transverse component of F (Fig. 54).

If the origin O coincides with the actual position of the centre of friction, the sum of the longitudinal component of the frictional forces (= sum of the ordinates NV, to the " force " scale) will be equal to the sum of the external longitudinal forces ; or $-\Sigma(\text{NV}) = \Sigma\text{T}$ (first equation of motion).

Measure the lengths NV for the different wheels W, and sum them, having due regard to sign ; if $-\Sigma(\text{NV})$ does not equal ΣT, the origin O must be moved along the perpendicular OY, and the process repeated, until approximate equality is obtained. This part of the determination need not be done accurately.

Assume now that this position O for the centre of friction is the actual one ; then the sum of the transverse components of the frictional forces (= sum of the abscissæ NU, to the " force " scale) will be equal to the sum of the known external transverse forces, plus the unknown flange force Q at the leading outer wheel of the truck ; or $\Sigma(\text{NU}) = \Sigma\text{P} + \text{Q}$ (second equation of motion).

Measure the lengths NU for the different wheels W, and sum them, having due regard for sign ; the external forces ΣP being known, a value can be assigned to Q, the unknown flange force.

If the centre of friction, as here assumed, coincides with the actual centre of friction, the truck will be in equilibrium, and the sum of the moments of the frictional forces F about the origin O (= sum of the products ON.OW, where ON is measured on the " force " scale, and OW on the " length " scale) will be equal to the sum of the moments of the known external forces about O, plus the moment of the unknown flange force Q about O ; or $\Sigma(\text{ON.OW}) = \Sigma\text{P}.a + \Sigma\text{T}.b + \text{Q}.u_a$. This can be re-written : $\Sigma\text{P}.a + \Sigma\text{T}.b + \text{Q}.u_a - \Sigma(\text{ON.OW}) = \text{O}$ (third equation of motion).

The lengths ON and OW for the different wheels W can be measured off the drawing, the external forces and lengths are given, and Q has just been determined ; consequently all quantities are known.

If the left side of the above expression amounts to zero, the truck is in equilibrium, the centre of friction M is correctly located at O, and its co-ordinates x and y can be measured off the drawing. If, however, the left side of the expression does not amount to zero, an unbalanced couple, which we may call **M**, will act on the truck, tending to turn it about the point of contact of the rail with the leading outer wheel flange, and this will cause the centre of friction to move. If the couple **M** is positive, the centre of friction will move forward ; if negative, the centre of friction will move backward.

To determine the equilibrium position, the origin O must be moved in the right direction along the axis OX to a new position O′. A new transverse axis O′Y′, and new lines O′W joining the new origin to the wheels must be drawn.

The second and third equations of motion are then applied again ; a new flange force Q′ is determined, and if the new residual couple **M**′ amounts to zero, it shows that the centre of friction M is now correctly located at O′. If not, the origin O must be moved again, and the process repeated.

Note.—The distance x' that the origin has to be moved in any particular case to make **M** = O, can only be determined by experience. An indication as to the approximate distance to be moved, however, can be got from the fortunate chance that both $\Sigma(\text{ON.OW})$ and Q vary very little as O is moved longitudinally. So we get :—

$$\text{Initially } \Sigma\text{P}.a + \Sigma\text{T}.b + \text{Q}.u_a - \Sigma(\text{ON.OW}) = \mathbf{M}$$
$$\text{Finally } \Sigma\text{P}(a - x') + \Sigma\text{T}.b + \text{Q}'(u_a - x') - \Sigma(\text{O'N'.O'W}) = \text{O}.$$

This gives, $x' = \dfrac{\mathbf{M}}{(\Sigma\text{P} + \text{Q})}$ approximately.

When the origin O has finally been brought very near to the equilibrium position of the centre of friction M, all three equations of motion should be applied to the truck as a check. It will probably be found that, due to the longitudinal movements of O, the transverse equilibrium position has been slightly altered ; by inspection, it should be possible to move the origin obliquely a small distance, so as to hit exactly on the equilibrium positions.

Summary of Equations.

$\Sigma\text{T} = -\Sigma(\text{NV})$ .. .. *First equation.*

$\Sigma\text{P} + \text{Q} = \Sigma(\text{NU})$ .. .. *Second equation.*

$\Sigma\text{P}.a + \Sigma\text{T}.b + \text{Q}.u_a - \Sigma(\text{ON.OW}) = \mathbf{M}$ } *Third equation.*
$\mathbf{M} = \text{O}$ for equilibrium }

Also, $x' = \dfrac{\mathbf{M}}{(\Sigma\text{P} + \text{Q})}$ approximate.

Example : Conditions.—A 4-6-0 express engine, whose relevant dimensions are shown on the diagram (Fig. 55) was passing round a 30½-chain curve, superelevated 3⅛ in., at a speed of 70 m.p.h., when it encountered a 1 in 20 crossing, and became derailed ; the crossing nose was on the outer rail of the curve, and a check rail was fitted opposite, at the inner rail. Derailment took place owing to the leading inner

* Weaver Junction, L.M.S.R. See *The Railway Engineer*, November, 1930.

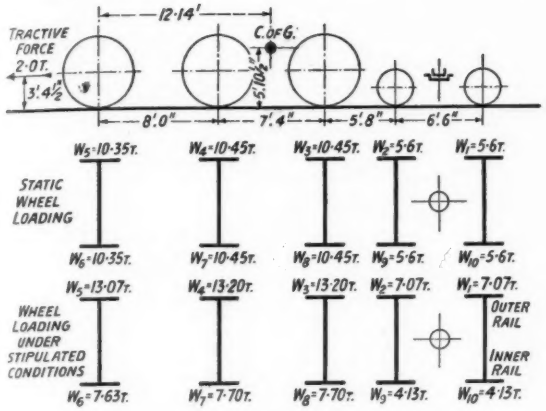


Fig. 55

coupled wheel climbing the check rail, and running on top of it; there was thus nothing to guide the leading outer wheel past the gap at the crossing, so it struck the crossing nose, climbed it, and fell outside the track.

The crossing was true to gauge; due to flange wear, the leading coupled wheels had $\frac{5}{8}$-in. extra side play in the track, $\frac{7}{16}$-in. at each wheel; this was within the limits allowed.

The weight of the bogie truck is 5·85 tons; the weight of the main truck is therefore 79·05 tons by difference. The stiffness of the bogie control springs (2) is 5·25 in. per ton, with an initial compression of $1\frac{1}{2}$ in., corresponding to an initial load of 0·57 tons. The tractive force at the time of the derailment is assumed to be 2 tons. The maximum hammer blow at 70 m.p.h. is 2·87 tons per wheel.

Alteration of Wheel Loading.—The overturning couple, due to the effects of centrifugal force and superelevation of the track,

$$\mathbf{W}h\left(\frac{v^2}{Rg}-\frac{e}{s}\right)=84\cdot9\times5\cdot875\left(\frac{102\cdot7\times102\cdot7}{2{,}013\times32\cdot2}-\frac{0\cdot260}{4\cdot92}\right)$$

$= 54\cdot8$ tons-ft. This causes a transfer of load from the inner to the outer rail of $\frac{54\cdot8}{4\cdot92} = 11\cdot12$ tons. For simplicity, assume this distributed over the axles in proportion to the axle loads; then the corresponding alteration in wheel loading is shown on the diagram (Fig. 55).

Known Forces, &c.—The outward force acting on each truck, at its C. of G., due to effects of centrifugal force and superelevation of the track, is $S=\mathbf{W}\left(\frac{v^2}{Rg}-\frac{e}{s}\right)$, where **W** is the weight of the truck.

Then,

$\left\{\begin{array}{l}\text{for bogie truck, } S_B = 0\cdot64 \text{ tons,}\\ \text{for main truck, } S = 8\cdot69 \text{ tons.}\end{array}\right.$

The C. of G. of the main truck is 11·24 ft. in front of the trailing coupled axle.

A preliminary drawing of the locomotive, using Roy's method, shows that the main truck is likely to adopt free curving, and that the deflection of the bogie centre will be about 0·97 in., corresponding to a side-controlling force B = 0·94 tons.

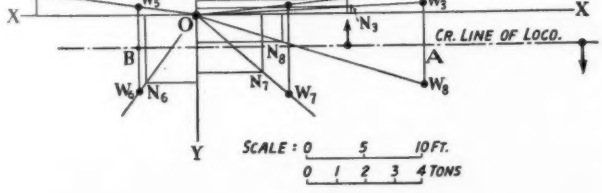


Fig. 56

Main Truck.—The sliding hypothesis is used, with $\mu = 0\cdot25$. Draw out the truck to a "length" scale of 1 in. = 1 ft., and for the first trial, place O at 3 in. (3 scale ft.) in front of trailing coupled axle, and 2 in. outside locomotive centre line AB. Let the "force" scale be 2in. = 1 ton. Mark off ON_3 ON_4 ON_5 ON_6 ON_7 $ON_8 = 6\cdot60$ in., 6·60 in., 6·54 in., 3·82 in., 3·85 in., 3·85 in., corresponding to μX, the respective wheel loads (Fig. 56).

Now $\Sigma T = 2\cdot0$ tons.

And $-\Sigma(NV) = -0\cdot24 - 0\cdot60 - 1\cdot00 + 3\cdot16 + 2\cdot56 + 1\cdot32 = 5\cdot20$ in., corresponding to 2·60 tons. Therefore $\Sigma T - \Sigma(NV)$ (first equation).

Move origin O a distance 0·25 in. towards locomotive centre line. Mark off ON_3 - - - ON_8 as before.

Then $-\Sigma(NV) = -0\cdot38 - 0\cdot92 - 1\cdot50 + 3\cdot10 + 2\cdot48 + 1\cdot24 = 4\cdot02$ in., corresponding to 2·01 tons. This is sufficiently near, and O is now 3 in. in front of trailing coupled axle, and 1·75 in. outside locomotive centre line.

For second equation, $\Sigma P = B - S = 0\cdot94 - 8\cdot69 = -7\cdot75$ tons.

And $\Sigma(NU) = 6\cdot58 + 6\cdot54 - 6\cdot36 - 2\cdot22 + 2\cdot94 + 3\cdot64 = 11\cdot12$ in., corresponding to 5·56 tons. Hence $Q = 5\cdot56 + 7\cdot75 = 13\cdot31$ tons.

For third equation, $\Sigma P \,.\, a + \Sigma T.b + Q.\mu a = 0\cdot94\,(21\cdot25) - 8\cdot69\ (8\cdot24) + 2\cdot00\ (1\cdot75) + 13\cdot31\ (12\cdot33) = 116\cdot1$ ft.-tons.

And $\Sigma(ON \,.\, OW) = 81\cdot5 + 33\cdot3 + 20\cdot2 + 19\cdot4 + 25\cdot2 + 50\cdot2 = 229\cdot8$ sq. in., corresponding to 114·9 ft.-tons. Hence residual couple $\mathbf{M} = 1\cdot2$ ft.-tons.

By approximate formula, distance that the centre of friction should be moved forward is $x' = \frac{\mathbf{M}}{(\Sigma P + Q)} = \frac{1\cdot2}{(-7\cdot75 + 13\cdot31)}$ $= 0\cdot22$ ft. (actual), or 0·22 in. on drawing. The second and third equations are then applied again to the new origin O'.

Finally, after further trials, it is found that centre of friction is 3·21 ft. (actual) in front of trailing coupled axle, and 1·74 ft. outside locomotive centre line. The flange force at the leading outer coupled wheel is 13·22 tons.

Similar trials can be made for the bogie truck (remembering that two centres of friction are possible), and it is found

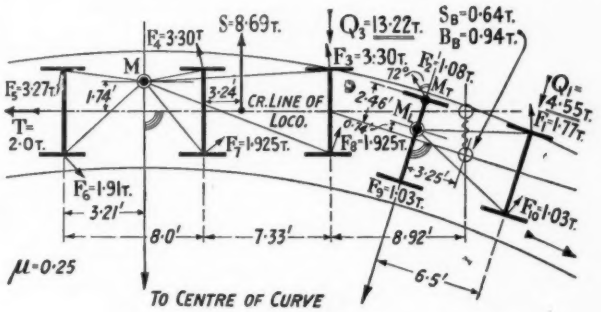


Fig. 57

that centres of friction are:—for leading pair of bogie wheels, at trailing bogie axle, and 0·74 ft. outside locomotive centre line; for trailing pair of bogie wheels, at outer trailing bogie wheel tread (this wheel therefore undergoes pure rolling without slip). The flange force at the leading outer bogie wheel is 4·55 tons (Fig. 57).

Further Calculations.—Having determined the flange forces, further calculations to any degree of complexity may be attempted. For example, an experiment was made to determine the lateral stiffness of a pair of driving wheels and axle, in which it was found that a transverse load of 9·1 tons applied at the tread caused a movement of 0·255 in. per wheel.

Before the check rail is reached, therefore, the leading outer coupled wheel will be deflected $\frac{13\cdot22\times0\cdot255}{9\cdot1} = 0\cdot37$ in. When the check rail is reached, the leading inner coupled wheel takes up the load; owing, however, to the $\frac{7}{16}$ in. (= 0·31 in.) extra side play due to flange wear, the inner

wheel must be momentarily deflected $(0{\cdot}37 + 0{\cdot}31) = 0{\cdot}68$ in., corresponding to a flange force of 24·3 tons.

As the back of the flange of the inner wheel moves down past the vertical side of the check rail, an upward frictional force $\mu \times 24{\cdot}3 = 6{\cdot}07$ tons will be exerted, tending to lift the wheel. If the balance weight happens to be in its worst possible position, a further upward force of 2·87 tons will be exerted, making a total upward force of 8·94 tons.

This is greater than the wheel load of 7·70 tons (Fig. 55); the wheel will therefore lift, and if the upward force lasts for a sufficient time, will climb on to the check rail. If a roll happens to take place at the same time, the wheel load will be still less, and the resultant upward force still greater.

This is, of course, only approximate. Furthermore, detailed calculations, too long to be reproduced here, indicate that the leading inner wheel flange will have mounted the check rail about 4 ft. after first striking it, without the assistance of a roll.

APPENDIX VII—The "B-E" bogie

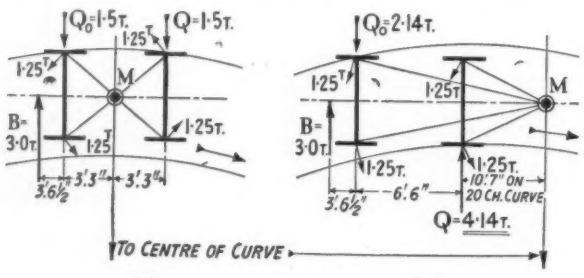
Satisfactory though the normal bogie may be on straight track, it would seem that full use is not being made of it on curves, so long as (*a*) only one wheel flange (the outer leading) takes up the reaction to the side controlling force; and (*b*) the bogie has an outward running tendency. To improve on the normal bogie, it is first necessary for the trailing wheel flange to be brought into contact with the outer rail, and relieve the leading flange of some of the reaction to the side controlling force.

Although an increase of side controlling force may bring the trailing wheel over to the outer rail, it defeats its own object by simultaneously increasing the flange force at the leading wheel. On the sliding hypothesis indeed, with normal values of μ, the leading flange force increases to such an extent as to cause derailment before ever the trailing wheel moves across.

A better method is to move the point of application of the check springs backward (without altering the position of the bogie centre, or the distribution of load on the wheels), so that the flange force at the leading bogie wheel is reduced, and the trailing wheel flange is brought over against the outer rail, thus giving less flange force at the leading wheel for the same side controlling force. (Alternatively, the controlling force can be increased for the same flange force.)

The best position for the check springs is clearly that which gives rise to equal flange forces at both leading and trailing bogie wheels. But this position depends considerably on the coefficient of friction μ (sliding hypothesis), or on the creep constant and radius of curve traversed $\frac{k}{R}$ (creep hypothesis), which are not constants in locomotive design.

In any case, this ideal position for the check springs often comes *behind* the trailing bogie axle, thus putting the bogie truck into a state of unstable equilibrium (Fig. 58*a*). In



58*a* 58*b*

the corresponding stable equilibrium position, the bogie runs askew across the track, and a large negative flange force acts at the inner leading wheel (Fig. 58*b*)—an attitude which is clearly inadmissible. It is therefore necessary to keep the point of application of the side controlling force within the bogie wheelbase, even if the flange forces at the leading and trailing bogie wheels are not equal.

The second step in the improvement of the bogie is to give it an inward running tendency, so as to allow large flange forces without danger of derailing (see part III*). Provided that the trailing flange is kept up against the outer rail, this can be done without affecting the bogie's freedom from rotational constraint, by fitting thin flanges to the trailing wheels. The bogie centre line will then be pointed inwards on curves, and the centre of friction, instead of lying as usual at the midpoint of the bogie wheelbase, will be moved forward. If the trailing flanges are sufficiently thinned, and the curves traversed are not too sharp, the centre of friction will be in front of the leading bogie axle, thus giving the bogie the desired inward running tendency.

To sum up: (1) The side controlling force must be large enough, and placed far enough behind the bogie centre, to ensure that the trailing wheel flange is always up against the outer rail, no matter how great the coefficient of friction may be; and (2) the trailing wheels must be given enough extra side play in the track, as compared with the leading wheels, to ensure that the centre of friction of the bogie truck remains in front of the leading axle on the sharpest curve that the engine has to traverse under running conditions.

As an example, consider a bogie truck, loaded to 20 tons, wheelbase 6 ft. 6 in. standard gauge, guiding a locomotive round a 40-chain curve on a dry day ($\mu = 0{\cdot}25$).

A bogie of normal type, with A.R.L.E.-type A flanges (total side play in true-to-gauge track = $\frac{5}{8}$ in.) front and

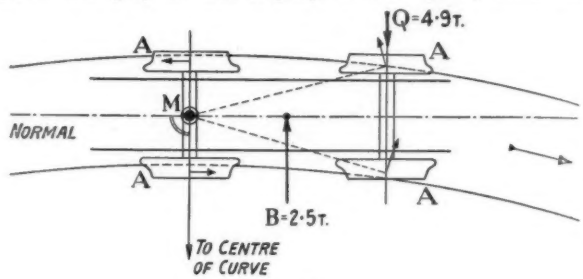


Fig. 59a

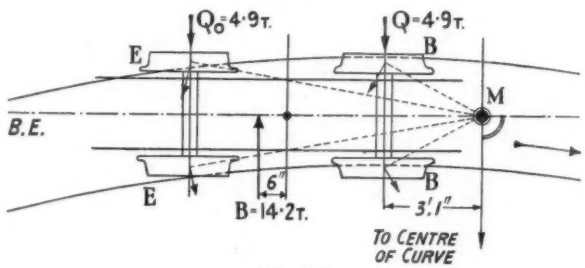


Fig. 59b

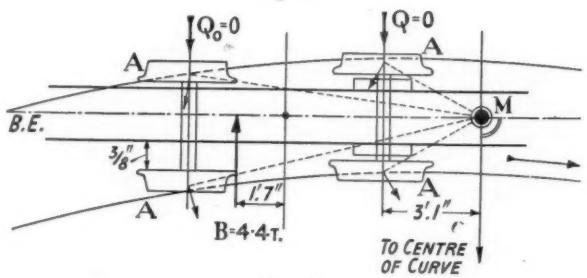


Fig. 59c

back, and exerting a side controlling force of 2½ tons at the bogie centre, will have its centre of friction at the middle of the trailing axle, and will give a flange force of 4·9 tons at the leading outer wheel (Fig. 59). The wheel load being 5 tons only, this is getting very near the safe limit, although 2½ tons is by no means an unusually large controlling force.

A bogie of the new type, having A.R.L.E.-type B flanges (total side play = ½ in.) in front, and type E flanges (total side play = $\frac{7}{8}$ in.) behind, will have its centre of friction

* Page 285 of *The Railway Engineer*, September, 1934.

3 ft. 1 in. in front of the front axle on a 40-chain curve, as long as the rear flange is kept up against the outer rail (Fig. 59).

To give a flange force of 4·9 tons, at both leading and trailing wheels, requires a side controlling force of no less than 14·2 tons, acting 6 in. behind the bogie centre. This is, of course, excessive, but shows what can be done without increase of flange force. Going to the other extreme, to keep both flanges just up against the outer rail, without exerting any flange force, requires a side controlling force of 4·4 tons, acting 1 ft. 7 in. behind the bogie centre. This shows that bogie flange forces can be abolished, and the side controlling force be increased 70 per cent., simply by getting the frictional forces at the treads of the wheels to assist, instead of hindering the curving of the locomotive.

The combination of flange profiles chosen for this example suggests the name " B-E " bogie ; but the same effect can be produced by using equal flange profiles (say A.R.L.E. type A) on both pairs of wheels, and giving the trailing pair a greater amount of sideplay in the axleboxes than is allowed to the leading pair ; in the above example, $\frac{3}{8}$ in. extra (Fig. 59*c*).

The following characteristics of the " B-E " bogie should be noted :—The position of the centre of friction depends on the radius of the curve ; as the curvature gets sharper, the centre of friction moves back until at one radius it lies on the leading axle. On sharper curves than this, the bogie ceases to be inward running. In the above example, the critical curvature is 20 chains, but as sharper curves involve a reduction of speed for express trains in this country, the safety of the train will not be affected.

On wet or greasy track, the coefficient of friction falls, causing a reduction in the frictional forces at the treads of the wheels, and a corresponding rise in the flange forces (the opposite of a normal bogie). This rise will not be harmful, however, due to the inward running characteristic which enables large flange forces to occur without danger of derailment.

Finally, and *most important*, the " B-E " bogie has been designed as a leading truck, and must be used only on main-line engines which, except in the running shed, normally do not run backward at all. It is totally unsuitable for a trailing truck ; the thin-flanged wheels then lead, so that the centre of friction is behind the back axle, and the frictional forces increase, instead of decreasing the flange force ; and the strong bogie check springs act in front of the bogie centre, throwing all the large side controlling force on the leading pair of wheels.

(The above examples have been worked out on the sliding hypothesis ; similar calculations can be made on the creep hypothesis.) (*Concluded*)

THE APPLICATION OF WELDING TO RAILWAY WORK

By C. W. BRETT, M.I.W.E.

WITHIN the scope of a brief article it is impossible to catalogue all the components which can receive attention by welding with assurance of entire success. Reference to recent developments and mention of certain examples of work, however, show that the scope of welding has vastly increased during recent years; whilst at the same time costs have been substantially reduced. It is unfortunate that owing to a lack of technical knowledge and skill on the part of the operator there are instances of work which could have been entirely successful but has not come up to expectations. The result has been that the engineer in charge has become prejudiced, and, quite naturally, he has not extended his welding trials wholeheartedly in other directions.

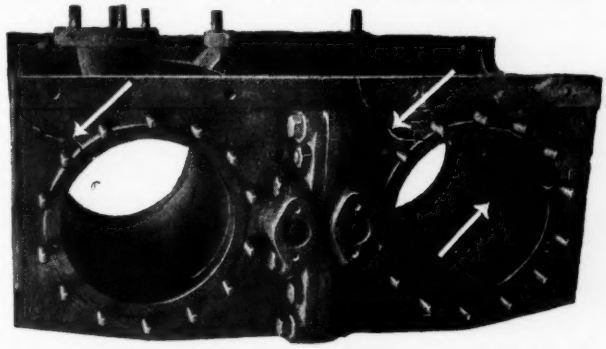
Apart from machine work, scientific welding requires not only a very high degree of skill on the part of the operator, together with experience in a wide variety of work, but the backing of a metallurgist thoroughly experienced in the matter of heat treatment. A class of repair which can now be undertaken with the certainty of success is that to the cylinders of a locomotive, and an instance of this is shown in the accompanying illustration. In this case there was an extensive series of cracks affecting both bores. With the aid of special heat-treatment and deft manipulation of the welding appliances, the cracked metal was united without any distortion of the casting After they had been machined, the castings showed no trace of the welding operation, and the cylinders were restored to their full efficiency and durability. A repair of this kind effects a very substantial saving, even in cases where replacement parts are readily obtainable.

The Barimar new low temperature process for cast iron and malleable parts has been instrumental in reducing the cost and increasing the speed of repairs. It is a daily occurrence to weld castings in position and without disturbing bearings or otherwise upsetting alignments. At the same time both the amount and cost of machine work is reduced, for little surplus metal remains to be removed after welding by this process.

Given an operator having the requisite skill to attain the speed and accuracy with which scientific welding repairs must be executed, elaborate plant is still essential. In all such work the choice of the correct electrode is also a matter of vital importance. For example, some of the more expensive specially-coated electrodes can be deposited at three times the rate of thinly-coated rods. Speaking generally, building-up work, such as that carried out on worn shafts, crosshead guides, cam and guide bars, locomotive and rolling stock bearing housings, is most successful when the largest electrode practicable is used, but it is experience alone that teaches a man exactly which size and type of electrode to use for each operation.

Obviously, railway engineers will wish to carry out welding repairs in their own workshops, but without the facilities already mentioned it is almost invariably cheaper to entrust all but simple work to specialists.

The time may not yet have arrived when it is practicable to substitute welding for riveting in the construction of locomotive boilers. There are, however, certain defects that are inherent in riveting and which can be remedied by welding. A riveted joint necessitates a lap, and where the fire impinges on boiler plates there must inevitably

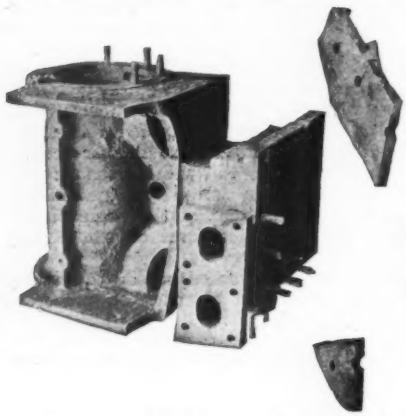


Locomotive cylinders which, after being badly cracked, were successfully repaired by scientific welding, at comparatively small cost. The repair was guaranteed and the cylinders were perfectly satisfactory in use ; it was carried out in the Barimar welding works

be a difference in the rate of expansion between the inner and outer laps, owing to one being in contact with the water whereas the other is isolated from it and is subject to the direct heat of the furnace. In such cases scientific welding is finding an ever-increasing sphere of usefulness.

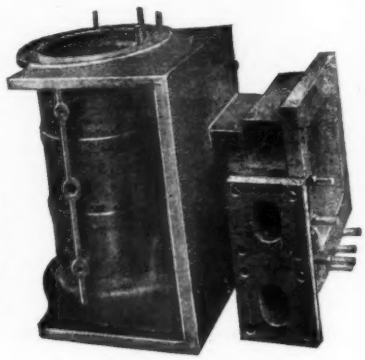
Welding is now being widely employed for reconditioning defective plates in industrial boilers, and provides a much more satisfactory repair than a riveted patch. It entails no weakening of the plates by drilling and it avoids the creation of crevices. In cases where the trouble is not serious a straightforward welding operation often suffices, but it is frequently necessary when a boiler is in a bad state of disrepair for a portion to be cut right out and replaced with a butt-welded patch.

Another phase of welding which has not received the attention it merits is the overcoming of an inherent weakness in design by reinforcing with new metal. To the skilled operator a fundamental fault on the part of the designer is at once apparent, and in such cases it is useless to restore a cracked or broken component to its original state. Additional metal must be built up to impart a greater measure of strength. There are examples of operations of this kind on bogie frames and other parts for which the cost has been a fraction of that of renewal. Quite apart from the restoration of parts which have failed, welding must be considered as a means for building up worn components. By the use of special electrodes or welding rods it is possible to weld mild steel, cast iron or malleable parts without in any way complicating subsequent machining. If it is not feasible to convey the part requiring attention to a welding shop, even the most difficult task can be handled by a mobile squad from a firm specialising in such problems. Lack of local facilities need therefore be no deterrent to the application of welding to repairs. As a further means of combating doubt as to the final result, a guarantee of " no cure, no pay " is invariably given by welding specialists who have the necessary plant and trained staff.



Left: Another damaged locomotive cylinder. This was broken along the flange that connects it to the engine frame

Right: The same cylinder after it had been repaired by scientific welding. The welding and machining, by the Barimar welding works, took less than 48 hours, and the cylinder was as strong as a new one without the slightest trace of repair



NEW 2-6-2 TANK LOCOMOTIVES, L.M.S.R.

(*See illustrations on page* 446)

THE first of a batch of 20 new two-cylinder 2-6-2 tank engines has just been completed at the Derby works of the London Midland & Scottish Railway, and is generally similar to the 70 locomotives numbered 1 to 70 inclusive, the first of which was described and illustrated in THE RAILWAY GAZETTE of April 18, 1930, page 603. The main difference between the present locomotive and its predecessors is in the boiler, which, in conformity with recent L.M.S. practice, is tapered. Principal dimensions are as follow:—

Cylinders, dia.	17½ in.
,, Piston stroke	26 in.
Wheels coupled, dia.	5 ft. 3 in.
,, leading and trailing, dia.	3 ft. 3½ in.
Wheelbase, coupled	16 ft. 6 in.
,, total	33 ft. 3 in.
Boiler pressure	200 lb. per sq. in.
Boiler heating surface—	
Tubes	774·5 sq. ft.
Firebox	103·9 sq. ft.
Superheater	75·9 sq. ft.
Combined total	954·3 sq. ft.
Grate area	17·5 sq. ft.
Tractive effort at 85 per cent. boiler pressure	21,486 lb.
Total weight in working order	70 tons 15 cwt.
Adhesion weight	45 tons 10 cwt.

The tube and superheater surfaces of the former engines of this class were respectively 692·75 sq. ft., and 172·75 sq. ft.

A steam manifold is provided on the top of the firebox door plate in the cab and carries valves for the ejector and steam brake, the injectors, carriage warming, whistle, pressure gauge, and a sight feed lubricator to the regulator. The main regulator is incorporated in the superheater header. Feed water is supplied to the boiler through top feed valves and distributing trays. There are two live steam injectors with 8-mm. cones, one on each side of the locomotive beneath the footplate. Two pop safety valves are mounted on the firebox. The fire door is of the standard sliding type, and a screen is provided to protect the enginemen's eyes from the glare of the fire. A steam atomiser carries out the lubrication of each piston and valve head. Standard mechanical lubricators are provided for the piston valves, cylinders, piston rod packing, and valve spindle bushes.

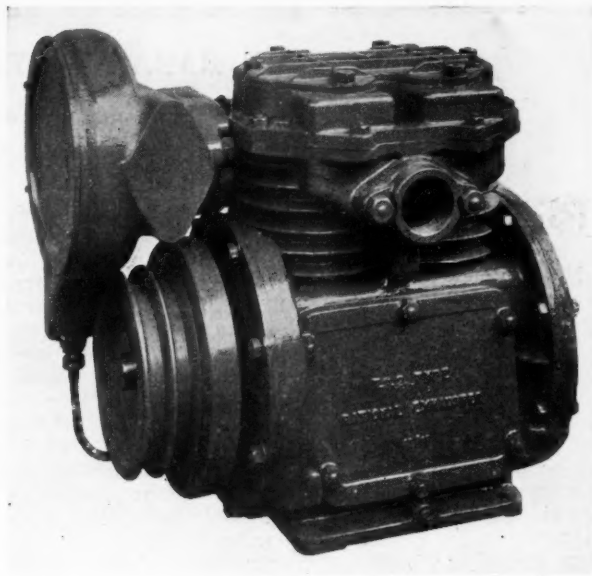
In accordance with the company's latest practice, high tensile manganese molybdenum steel is used for the fluted connecting rods and the rectangular section coupling rods. A Gibson type retaining ring secures the tyres. Axleboxes and their lubrication are of the latest standard pattern, as fitted by Mr. W. A. Stanier, the Chief Mechanical Engineer. All the laminated bearing springs, the plates of which are of ribbed section, with cotter type fixing in the buckle, are made of silico-manganese steel. The spring links are screwed to permit of adjustment. The coal and water capacities are 3 tons and 1,500 gall.

VACUUM EXHAUSTERS FOR DIESEL AND OTHER MOTIVE POWER UNITS

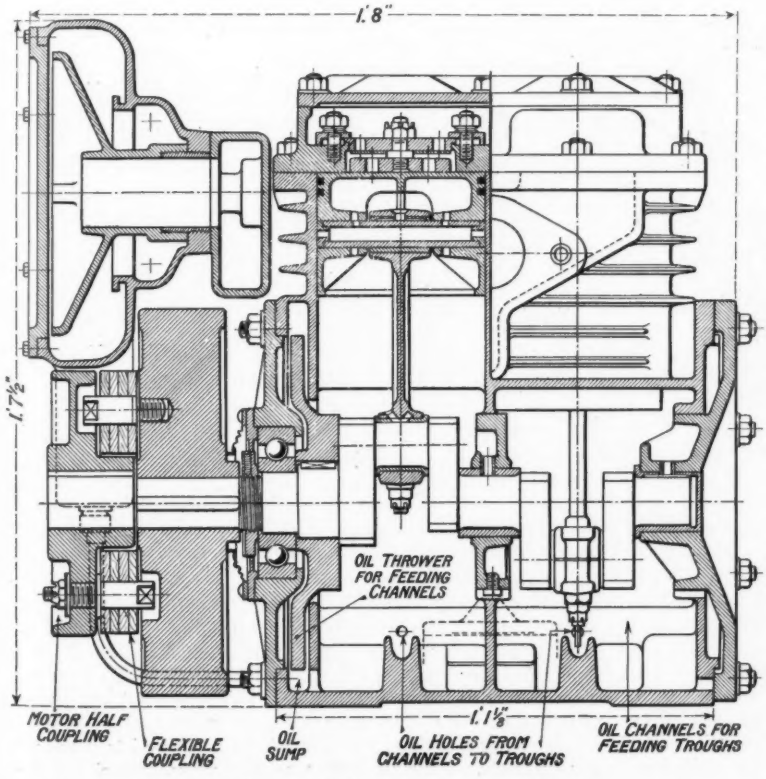
An attractive design of high capacity for small piston-swept volume and overall size, readily adaptable to internal combustion and electric railcar and locomotive units

AS in the case of the steam locomotive, the growth in power of diesel, petrol, and electric units for rail traction has necessitated the provision of increased brake power for safe working. In power units in which the vacuum principle is adopted for braking, the exhauster must be operated mechanically, as steam is not available. The primary essentials of such exhausters are: silence in action; low power requirements; small and compact size; complete reliability; automatic action, both as regards vacuum maintenance and lubrication; and efficient cooling, particularly where tropical conditions are experienced. Two essentials which in some measure are inter-related deserve special emphasis. The train pipe side of the exhauster, while the brake is being held off, is in a state of vacuum, or negative pressure, and there is a continual tendency for oil to be sucked back from the exhauster on its discharge stroke, or, if a rotary design, during its discharge cycle, into the train pipe, with attendant deleterious effect upon the hose and other brake fittings. For this reason, apart from questions of economy, which, of course, apply also, the amount of oil used to lubricate the exhauster must be kept to a minimum, and there is the attendant problem of keeping the exhauster, in which the speed of rubbing surfaces—particularly peripheral speeds in the orthodox rotary type machine—are high, within a reasonable range of temperature limits.

It is claimed for the Rational series of high-speed exhausters being manufactured by the Heatly-Gresham Engineering Co. Ltd. in its Salford works that the problems stated have been efficiently solved.



General view of Rational vacuum exhauster



Part sectional elevation of vacuum exhauster

Briefly the principal features are as follow: a direct, belt or chain drive may be used from the main engines, transmission or electric motors without internal or external gearbox, giving speeds of from 960 to 1,450 r.p.m., thus bringing its application within the range of synchronous a.c. motors. The two, or multiple of two, cylinders, single-acting, and arranged vertically, designed on established vertical engine proportions and having also anti-friction bearings at the driven end, give the minimum of vibration. The light automatic plate valves, of special alloy metal with valves, cages and springs assembled in readily removable housings, are designed for silent action and require the minimum of adjustment (a particularly acceptable feature when unskilled labour is employed) and the minimum stock of parts for replacement.

Special lubrication with feeding troughs, clearly illustrated in the accompanying drawing, ensures a low oil consumption and a minimum temperature rise, the limit always being within a safe range under all conditions. Over-oiling is impossible, as a foolproof filler is used.

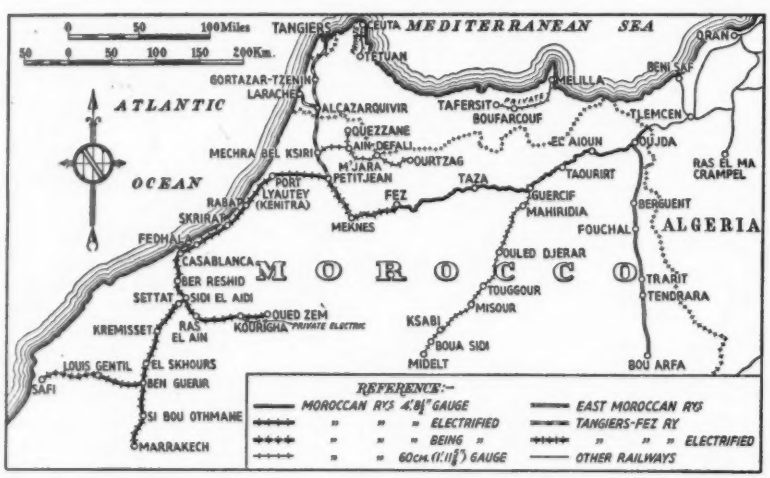
That small size and weight for a

reasonably high capacity has been admirably met in the design may be gathered from the fact that the unit illustrated provides, within overall dimensions of 1 ft. 8 in. by 1 ft. 7½ in. by 1 ft. 1 in., a piston diameter of 4¾ in. and stroke of 3¼ in. and a weight of 308 lb. for the exhauster alone, the ability to exhaust at the rate of 70 cu. ft. a min. from a pipe 2 in. in diameter, and to maintain a vacuum of 26 in. Such units, with their high capacity for small piston-swept volume, may readily be accommodated in the framing or alongside the transmission of most railcars and locomotives. They are made in a range of sizes to meet all railway requirements from small railcars to main line locomotives, and also for vacuum testing apparatus.

THE RAILWAY SYSTEM OF MOROCCO

Developed from numerous narrow-gauge military lines, the railways of Morocco are now among the most up-to-date in the world

BEFORE the signing of the Act of Algeciras in 1906, authorising France to establish a protectorate, wheeled vehicles were virtually unknown in Morocco, and the rudimentary mail system was maintained by foot runners employed by Europeans. In 1908 a 24-mile length of 2 ft. gauge railway was opened from Casablanca inland to Ber Reshid, the first line in Morocco, and subsequently replaced by a broad gauge line. A great change began when the Protectorate Treaty between France and the Sultan of Morocco was concluded at Fez on March 30, 1912. Railway plans were delayed by diplomatic negotiations with Germany. The Franco-German agreement of 1911 stipulated that France was to build no standard gauge lines until the Franco-Spanish line from Tangiers to Fez had been begun, but to further the military operations requisite for the pacification of the country, the French started to build in 1911 a system of 60-cm.



Map showing the various railway systems in Morocco

gauge lines extending from the Algerian frontier through Oujda, Fez, Rabat, and Casablanca to Marrakech in southern Morocco. These light railways were of considerable utility in the development of the country in the early years of the Protectorate, although they were operated by the military authorities until 1916. From that year until 1922 they were organised as a State system with the title of "Régie des Chemins de Fer à voie de 60 cm.," but in 1922 the Moroccan Railways Company was formed by the Cie Générale du Maroc, the Cie Marocaine, and the P.O. and P.L.M. Railways. This organisation was charged with further railway development in Morocco and given control of the light railways, all of which have now been taken up except for the line from Guercif to Midelt, and that from Mechra bel Ksiri to Ouezzane and the Ouergha valley. There is, however, a short length of private narrow-gauge railway in the neighbourhood of Melilla.

Construction of standard gauge railways was further delayed by the outbreak of the war. The Treaty of Versailles swept away the last legal obstacle, although changed economic conditions brought increased costs and formed fresh obstacles. The general aim underlying the railway system in Morocco was to connect the port of Casablanca with the principal cities and with the Tangiers-Fez Railway, and to provide important strategic and commercial routes with Algeria by the line from Fez to Oujda. The official opening of the line from Fez to Taza and the Algerian frontier by the Sultan last May practically marks the completion of the Moroccan railway system.

The railways in that country now comprise 1,088 miles of standard-gauge line owned by three companies, as follow:—

	Miles
La Cie. Franco-Espagnole du Chemin de fer de Tanger à Fez (Tangiers–Fez Railway)	197
Branch line (Spanish zone), El Ksar to Larache	25
	222
La Cie. des Chemins de fer du Maroc (Marrakech–Casablanca–Petit Jean, Fez–Oujda) ..	684
La Cie. des Chemins de fer du Maroc Oriental (East Moroccan Railways Company), Oujda–Bou Arfa	182

Tangiers-Fez Railway

The Tangiers-Fez Railway runs from Tangiers on the Strait of Gibraltar through the International and Spanish zones to Fez in the French zone of Morocco. Construction of the T-F Railway was undertaken by the Franco-Spanish company which was definitely constituted on June 26, 1916, after years of diplomatic negotiations. The board of fifteen directors is composed of 60 per cent. French and 40 per cent. Spanish representatives, and the company's capital of 15,000,000 fr. was subscribed in the same proportion by French and Spanish interests. The head office is in Paris and the administrative office at Meknes. General meetings of the shareholders are held alternately in Paris and Madrid.

The general manager is French and the assistant manager Spanish. Officials and employees are French in the French zone and Spanish in the Spanish zone as far as

possible, while they comprise equal numbers of French and Spanish in the Tangiers zone, though employees of other nationalities may be engaged. Each zone exercises independent control and keeps separate accounts. The line is financed by bond issues guaranteed by the French and Spanish Governments.

As a consequence of the war the original plans and costs had to be revised and actual construction was not begun until 1919. It made slow progress until 1921, as economic difficulties were encountered. Plans were further simplified to lessen costs, and native labour used instead of European. In June, 1923, the section from Petit Jean to Meknes was opened, and in October of the same year the line was extended to Fez. Successive sections from Petit Jean to Tangiers were opened and the entire line was in operation on July 1, 1927. The length of 197 miles comprises 11 in the International, 58 in the Spanish, and 128 miles in the French zone. The branch line of 25 miles from El Ksar to Larache is entirely within the Spanish zone.

Stations, workshops, and depots were constructed in reinforced concrete to a standard design capable of extension as required. The same system has been adopted on the other Moroccan lines, and constructional work in Morocco as a whole has been carried out according to the carefully prepared plans of engineers and architects of the P.O. and P.L.M. Railways of France. The same applies to the rolling stock; much of this is of the same type as used by these companies in France, though coaches have been designed to meet the special climatic conditions of Morocco.

Operating regulations are based largely on the P.L.M. Algerian system. Trains include a fourth class with extremely low fares for natives (five to ten centimes a kilometre), and these low rates are found an effective means of meeting automobile competition throughout Morocco. Fares and freight charges in the French and Tangiers zones are levied in francs and in the Spanish zone in pesetas. Night trains include sleeping cars of the International Sleeping Car Company which maintains an office in Tangiers for the convenience of tourists. The tourist traffic forms an important source of revenue for the Moroccan railways.

Goods traffic comprises imported foodstuffs, construction material, agricultural machinery, machine tools, and fertilisers. The import traffic on the Tangiers-Fez line consists mainly of cereals and other agricultural produce. The principal places served are Tangiers, Meknes, Fez, and Petit Jean, the last named being an important junction with the Moroccan Railways to Kenitra (Port Lyautey), Casablanca and Marrakech.

Moroccan Railways

The Moroccan Railways (Cie. des Chemins de fer du Maroc) was definitely constituted on February 10, 1922, with a capital of 50,000,000 fr. The head office is in Paris. In 1916 a " Société d'Etudes " began to prepare plans, but it was not until Marshal Lyautey took the matter in hand after the armistice that a start was made with the lines from Kenitra to Petit Jean and from Casablanca to Rabat.

In the last twelve years progress has been rapid, and the company's system now totals 684 miles of standard-gauge lines, as follows:—

	Miles
Casablanca–Port Lyautey–Petit Jean	133
Casablanca–Marrakech	154
Sidi el Aïdi–Oued Zem	75
Fez–Oujda	233
Ben Guerir–Safi	89
	684

The Ben Guerir-Safi line is at present open only as far as Louis Gentil, 39 miles from Ben Guerir. The narrow-gauge sections are from Mechra bel Ksiri to the Ouergha valley, 85 miles, and from Guercif to Midelt, 165 miles. A diesel locomotive is at work on the former division.

Economic changes after the war led to modifications of the original plans, but the line connecting Rabat with Petit Jean was pressed forward and opened to traffic on June 1, 1923. Discovery of rich phosphate deposits at Oued Zem in southern Morocco brought a decision to build the line from Casablanca to Marrakech and to carry it as far as Sidi el Aïdi, thence constructing a branch line to Kourigha, centre of the mining area, and Oued Zem. From Kourigha down to the sea, an almost continuous slope presented favourable conditions for the transport of heavy loads. The first phosphate trains began running down to Casablanca on September 1, 1923, and the line was completed as far as Oued Zem in the summer of 1925.

After the phosphate line was built, attention was directed to linking Casablanca, the chief port of Morocco, with Rabat, the administrative capital, thus affording communication also with Fez and Tangiers via Petit Jean. The line was carried under the old city of Rabat through three tunnels with a total length of nearly 1½ miles, and was opened in June, 1925. Next, the line from Casablanca through Sidi el Aïdi was extended to Marrakech and opened officially November 7, 1928. Casablanca was thus connected with the three Moroccan capitals of Marrakech, Rabat, and Fez. Six miles from Marrakech great difficulty was encountered in carrying the line across the Tensift. A bridge of four arches, each with a span of 85 ft., was built, but to find firm foundations five caissons of reinforced concrete had to be sunk to depths of more than 60 ft. below the water level.

The branch from the Marrakech line, now in course of construction from Ben Guerir to the port of Safi, was not included in the original plans of the Moroccan Railways. It is intended to serve the phosphate mining district of Louis Gentil, and phosphates will be shipped from Safi. The section of 39 miles from Ben Guerir to Louis Gentil was opened on November 23, 1932. Contracts for the length of 50 miles from Louis Gentil to Safi have been awarded and the construction is being pushed ahead.

One of the outstanding events in the history of the Moroccan Railways was the opening in May this year of the line from Fez to Taza. This line extends through Oujda to the Algerian frontier and completes the connection of the Moroccan with the Algerian and Tunisian systems. There now exists a great transversal railway in North Africa, running from Marrakech in southern Morocco to Gabes in southern Tunisia, with a length of 1,688 miles, equivalent to the distance from Paris to Constantinople.

From Fez to the Algerian frontier the line has a length of 233 miles, and was originally of 2-ft. gauge. The section from the frontier to Oujda, about 11 miles, was converted to normal gauge in 1915 and operated provisionally by the P.L.M. Algerian system. From Oujda to Fez, and especially from Taza to Fez, railway construction presented great difficulties owing to the mountainous nature of the country. The original plans provided for the completion of the line in 1936, but the work was accelerated and the line opened officially by the Sultan of Morocco in May last.

Over 1,000 Europeans and 10,000 natives were employed in the constructional work, and the total cost was 600 million fr. exclusive of rolling stock. There are ten tunnels with an aggregate length of 11 km., the longest being 2·6 km.; most of them are lined in concrete. One

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of the most noteworthy features of the line from Fez to Oujda is the complete absence of level crossings. The rails are 18 m. (59 ft.) long, and weigh 46 kg. per m. (92·5 lb. per yd.) in the open and 55 kg. per m. (111 lb. per yd.) in tunnels. A portion of the passenger service is operated by Micheline railcars.

The line from Oujda to Guercif (105 miles) was opened in the spring of 1932 and the Guercif-Taza section (42 miles) in the following spring. Numerous tunnels, bridges, viaducts, extensive excavations, and masonry construction made progress slower over the 75 miles from Taza to Fez, but the work has been finished more than a year ahead of the allotted time. The Moroccan Railways have also received a concession for the construction of a line from Oujda to Nemours, on the Mediterranean coast, which will provide a shorter route between France and Morocco.

Included in the stock of 50 steam locomotives are 19 two-cylinder simple 4-6-0 engines with coupled wheels of 1·76 m. (5 ft. 9 in.) diameter and cylinders 500 mm. by 650 mm. (19·7 in. by 25·6 in.). Some of these were built by the North British Locomotive Co. Ltd., as were a number of the 2-8-2T engines, which have 1·35 m. (4 ft. 5 in.) wheels and 600 mm. by 650 mm. (23·6 in. by 25·6 in.) cylinders. Both types are Paris-Orleans Railway standard designs.

East Moroccan Railways

The East Moroccan Railways Company (Chemins de fer du Maroc Oriental) was formed to take over a light railway running from Oujda to Bou Arfa, which served to transport manganese ores from the mines in that area. The line was converted to normal gauge, and has been approved for possible use as the first section of the Trans-Saharan Railway. It runs southward parallel to the eastern border of Morocco and is 182 miles long. Owing to the depreciation of sterling and the Russian dumping, the manganese trade is no longer profitable, and alfa (esparto grass) from the high tablelands and merchandise required for the scanty population are now the principal items of the goods traffic. Coal has been discovered at Djerada, and this now supplies an appreciable tonnage for a part of the line, but operation of the line has been transferred to the Moroccan Railways. Total traffic receipts of the East Moroccan line in 1933 were 927,610 fr., against 609,110 fr. in 1932.

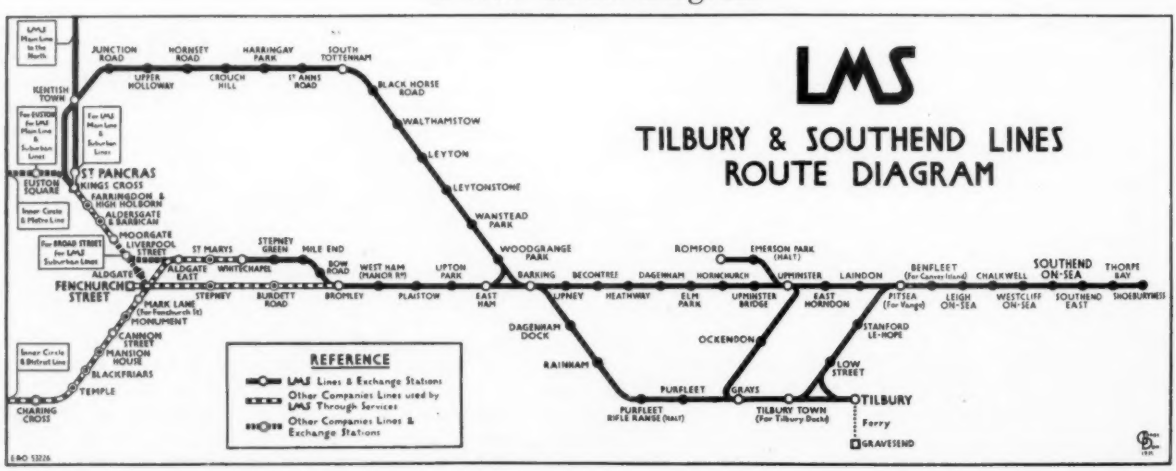
Electrification and Road Transport

Electrification of the Moroccan Railways has been carried out gradually since 1927, and all the standard-gauge lines of that company west of Fez are now operated electrically. The Tangiers-Fez Railway is also electrified between Petit Jean and Fez, making a total of 401 route miles of railways electrified. All the Moroccan electrified lines were described in detail in the *Electric Railway Traction Supplement* for November 16. Railcars are to be run from Oran on the Algerian coast through Oujda to Fez, Casablanca and Marrakech, and it is anticipated that the time of the entire journey from Paris to Marrakech may be cut by ten hours, making possible effective competition with the route through Spain and Tangiers.

The Moroccan Railways are supporting plans for rail and road co-ordination; they have always co-operated with road services, such as those along the coast from Casablanca to Mazagan, Safi, and Mogador, where no railways now exist, and in many parts combined road and rail tickets are available. Railway-owned motor lorries are used for the collection of grain and other farm produce, and the total tonnage of grains transported in 1933 was 131,956 tons.

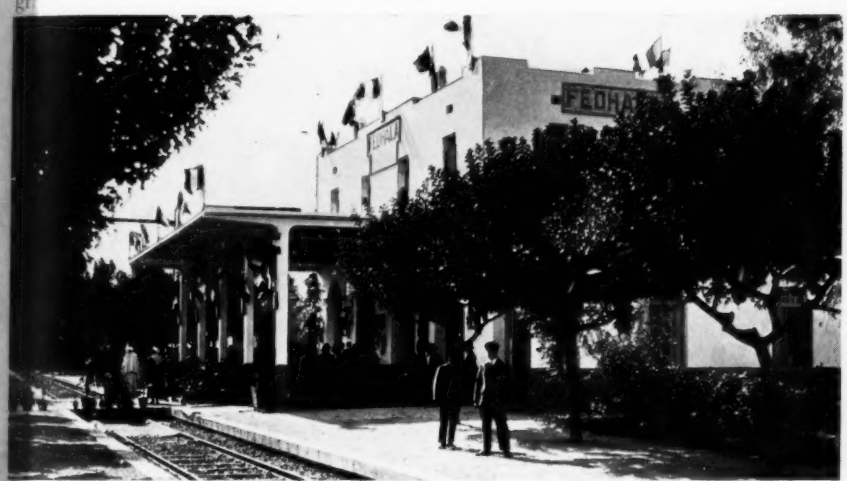
The principal road transport organisation is the Compagnie Auxiliaire de Transports au Maroc (C.T.M.), which runs motor services connecting all the towns of Morocco. La Valenciana, a Spanish company with head office at Tetuan, also serves the Spanish zone and runs cars to Casablanca. Excellent roads, kept up at a cost of 50,000,000 fr. a year, facilitate the motor-car traffic. The Moroccan roads now comprise a total length of 3,950 miles, of which the main highways account for 2,415 miles.

A New Route Diagram



We illustrate herewith the type of route diagram now being introduced into the compartments of trains running on the Tilbury and Southend lines of the L.M.S.R. The original, which is in red and black, was designed by Mr. George Dow, who was responsible for the somewhat similar style of map displayed in suburban trains of the L.N.E.R. (G.C. section) and reproduced in our issue of April 29, 1932. The present example has the same characteristics of detailed information regarding a large area shown in a compact and legible form, without resorting to a purely geometrical layout. It should be explained that lines of other companies used by L.M.S.R. through services are actually shown in red with black borders, but have here been broken for black and white reproduction.

Right: Oujda station at the eastern end of the new trunk line between Fez and Algeria which follows generally the line of an old narrow gauge military line. The illustration shows the station after the official opening ceremony on May 17 last



SCENES ON THE MOROCCAN RAILWAYS

Left: Station at Fedala, the first halt out of Casablanca on the Atlantic coast line to Port Lyautey

Below: Rabat-Ville station. The railway is carried under part of the town in three tunnels in order to preserve the Moorish aspect of the old city

Left : French-built 4-6-0 steam locomotive backing on to special train, Moroccan Railways. This and the locomotive shown below are standard types of the Paris–Orleans Railway

Below : Standard-gauge two-cylinder simple 2-8-2 tank locomotive as used on the Atlantic coast division of the Moroccan Railways

Below : Arrival of the S.S. "Arcadian" with tourists at the new Atlantic port of Casablanca. The train is hauled by one of the 2-8-2 tank locomotives shown in the centre illustration

SCENES ON THE MOROCCAN RAILWAYS

NEW LOCOMOTIVES FOR THE CENTRAL RAILWAY OF PERU

A 2-8-0 type designed for passenger service

BEYER, PEACOCK & CO. LTD., of Gorton, Manchester, has just shipped three tender locomotives of the 2-8-0 type for service on the Central Railway of Peru, the highest standard gauge railway in the world. The eight-coupled locomotives on this railway were originally of the 2-8-0 type followed by 2-8-2 and finally in 1924 by the 4-8-2 type. A return has now been made to the 2-8-0 type, presumably because of its lower total weight, an all important factor on a ruling gradient of 1 in 25. The locomotives are built to the designs of the Chief Mechanical Engineer, Mr. T. Jefferson, and to the specification of Livesey & Henderson, Consulting Engineers to the Peruvian Corporation.

The main gradient, as already stated, is 4 per cent. (1 in 25), and the maximum is 4½ per cent. (1 in 22), with no compensation allowed for curvature. From Chosica to Galera, a distance of 120 km. (74 miles), the grade is practically continuous 1 in 25. The sharpest curves, of which there are numerous examples and which occur with very little tangent between them, have a radius of 328 ft., and a superelevation of 4 in., while the line between Lima and Oroya contains no less than 41 bridges, 61 tunnels, and 13 reversing stations.

The specification of these engines has been very carefully considered in every detail, and various specialities have been included with a view to obtaining the most economical working under the severe conditions existing on this railway. To appreciate fully the difficulties surrounding the choice of a type for passenger service for this railway, the following table of altitudes gives a very good idea of the exceptional conditions:—

Distance from Callao, Kilometres	Station	Altitude, Feet
—	Callao	12
14·0	Lima	502
29·6	Santa Clara	1,324
54·0	Chosica	2,821
76·0	San Bartolomé	4,964
91·0	Surco	6,676
102·9	Matucana	7,840
120·3	Tamboraque	9,871
126·6	San Mateo	10,551
134·5	Rio Blanco	11,502
140·9	Chicla	12,250
153·4	Casapalca	13,632
172·3	Galera Tunnel (*a*)	15,693
193·5	Yauli	13,588
222·0	Oroya	12,225
274·6	Llocllapampa	11,367
301·2	Jauja	10,997
308·2	Huamali	10,923
320·5	Matahuasi	10,713
324·5	Concepcion	10,668
330·6	San Geronimo	10,649
346·0	Huancayo	10,692
From Ticlio		
2·1	La Cima (*b*)	15,806
14·26	Morococha	14,888

(*a*) Highest point on main line.
(*b*) Highest point on Central Railway.

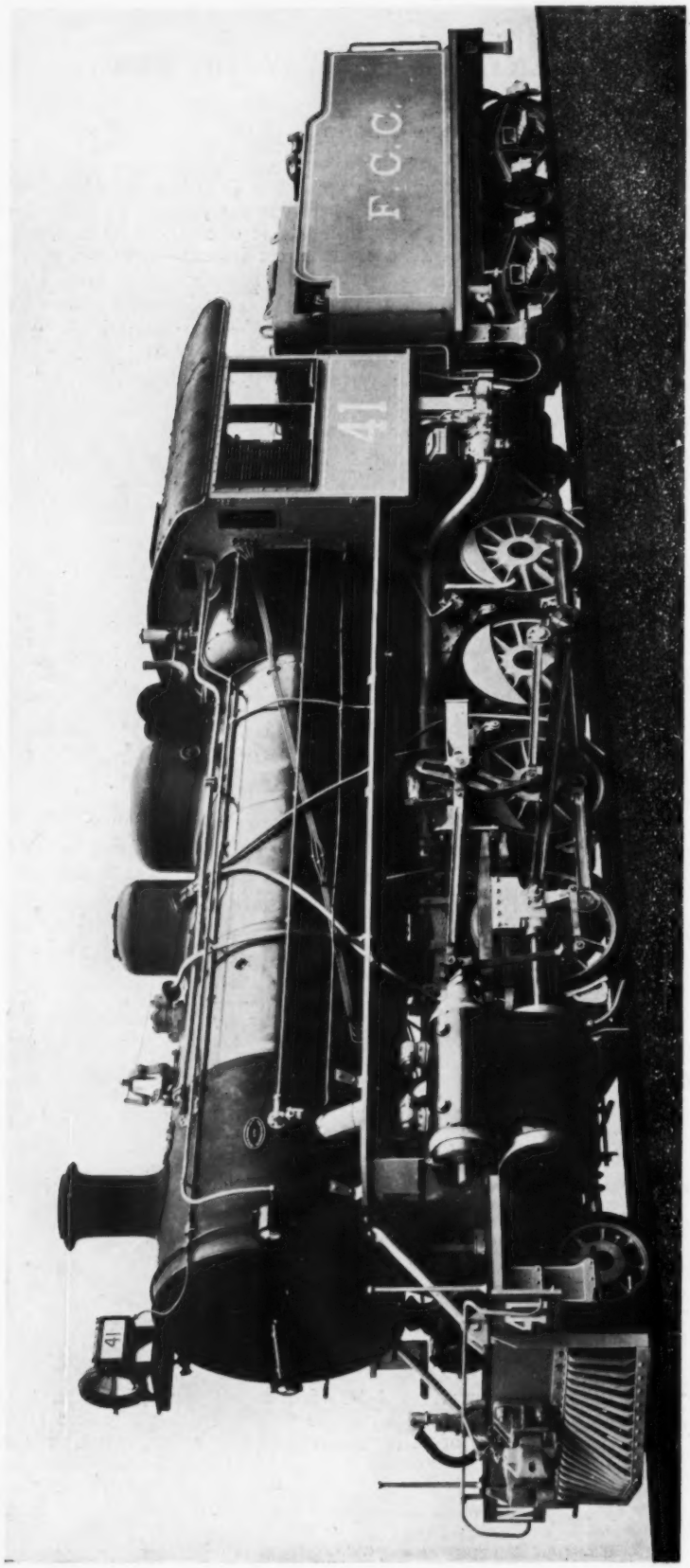
Front end view of locomotive

The leading dimensions of the locomotive are as follow:—

Cylinders	20 in. dia. × 28 in. stroke.
Coupled wheels	4 ft. 4 in.
Boiler pressure	200 lb. per sq. in.
Heating surface—	
Firebox	137 sq. ft.
Tubes	1,555 ,,
Thermic syphon	25 ,,
	1,717 ,,
Superheater (inside)	341 ,,
Total	2,058 ,,
Grate area	28 sq. ft.
Wheelbase—	
Engine	23 ft. 7 in.
Rigid	14 ft. 3 in.
Total engine and tender	49 ft. 2½ in.
Maximum axle load	16¼ tons
Weight of engine in working order	74 tons 2 cwt.
,, tender ,, ,,	37 ,, 5 ,,
Total weight	111 ,, 7 ,,
Tractive effort at 75 per cent. boiler pressure	32,300 lb.
Factor of adhesion	4·5

The previous 4-8-2 type engine supplied had a total weight of 123½ tons; the present engines therefore effect a saving of 12 tons. The boiler, however, is not quite so large, but is, on the other hand, provided with a Nicholson Thermic Syphon, which will considerably assist circulation of the water and augment the steam raising capacity of the boiler.

The severe strains imposed on the locomotive by the conditions on the railway necessitate the most robust con-



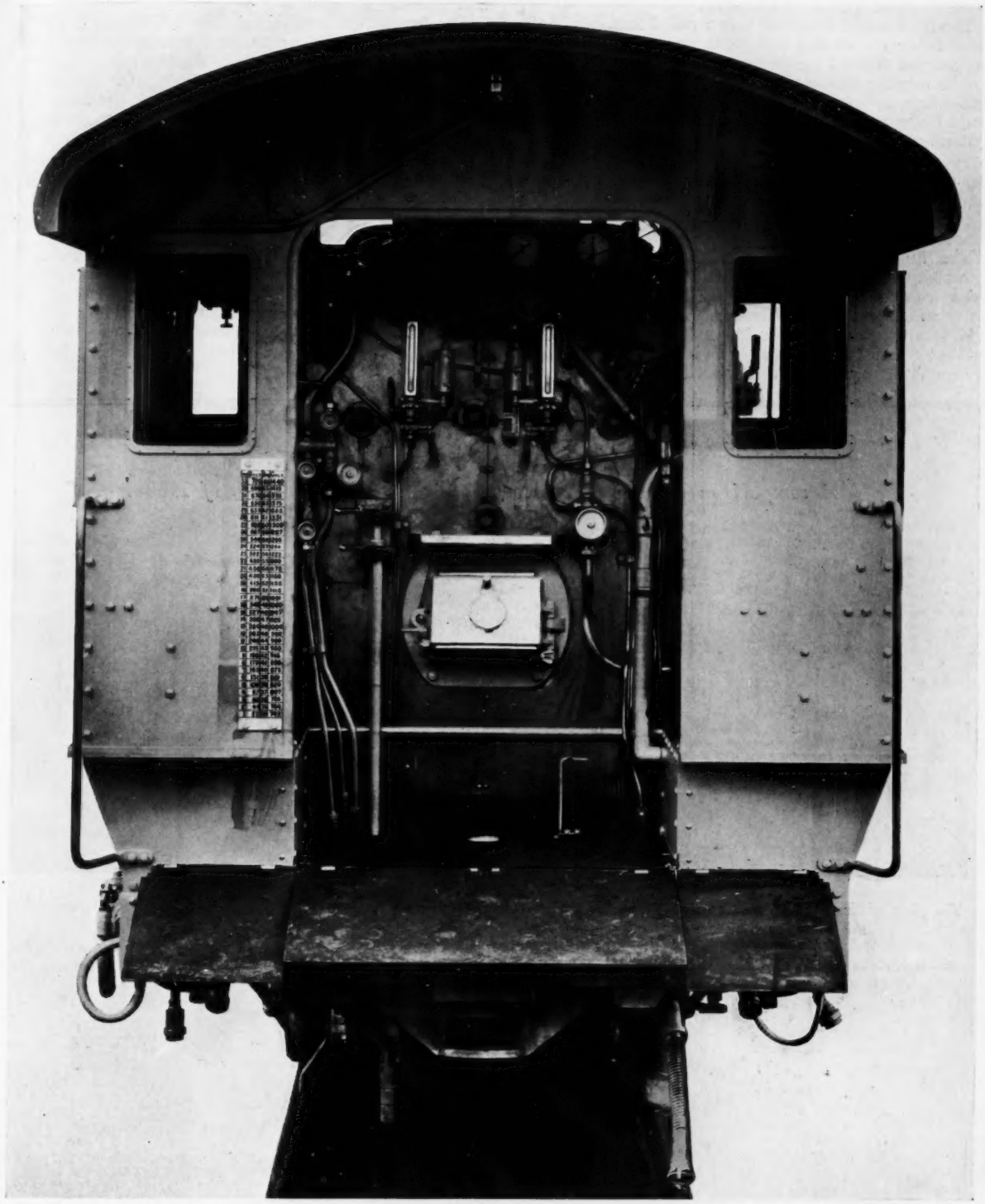
New 2-8-0 type passenger engine built by Beyer, Peacock & Co. Ltd. for the Central Railway of Peru

struction and accordingly the bar frames are of chrome vanadium steel, 4 in. thick, machined from the solid slab. The boiler, made of mild steel plates to the specification of the American Society for Testing Materials, is designed and stayed for a working pressure of 200 lb. per sq. in., and is surmounted by a dome, pressed in one piece, with a one-piece dished steel cover. The inner firebox of steel is stayed to the outer shell by stays of Longstrand steel, and fitted, as mentioned with a syphon welded to the firebox, which is arranged for oil burning. Flexible stay bolts are arranged in the breaking zones, these being carried well down the sides, as it can well be imagined that the several hours' " slogging " on the 4 per cent. grade, and with oil burning, places the severest possible strains on the boiler. The barrel contains 21 large tubes of $5\frac{3}{8}$ in. outside diameter and 155 small tubes of 2 in. outside diameter, made of Howell's Aquacidox galvanised steel, prossered and copper ferruled at the firebox end; after testing in Peru, the tube ends will be beaded and welded. The Superheater Company's superheater is fitted, with a M.L.S. multiple valve header in the smokebox. The boiler is lagged with asbestos mattresses of Limpet brand clothed with planished steel plates.

Owing to bad water the firebox has been amply provided with wash-out doors and washing out plugs. Blow down cocks are arranged on each side of the firebox and operated from the cab. The mud door at the bottom of the barrel is fitted with a screwed plug and all wash-out plugs are of stainless steel. The fittings on top of the boiler, enumerated from the front, are: bell, Gresham & Craven's Duplex heater and feed check valve, sandbox, steam dome with main stop cock, Stone's electric lighting set of 5 kW. capacity for lighting the train as well as the engine, Ross pop safety valves, and Crosby chime whistle.

The boiler is fed by one Gresham & Craven non-lifting injector and a Davies & Metcalfe exhaust injector, which, as mentioned, feed the boiler through the Gresham & Craven Duplex heater. The water level is indicated by two Klinger reflex glass water gauges and in addition three test cocks. The oil burning and rail cleaning jets and whistle are supplied with superheated steam.

The cylinders are of cast iron and follow the usual bar frame construction, uniting in the centre to form the saddle bearing for the boiler. The pistons have three rings and are of cast iron box type; by-pass valves are fitted over the steam chest and the piston-rod packing is Britimp cast iron type. The



General view of enclosed cab and fittings on 2-8-0 type locomotives of the Central Railway of Peru. The enginemen are provided with upholstered seats and armrests

crosshead and slide bars are arranged on the Laird two bar principle. The Walschaert valve gear is controlled by a hand screw reversing arrangement, and the return crank is fitted with a ball bearing.

The front bogie, equipped with a radial arm, has Skefko roller bearing axleboxes and is compensated with the leading coupled wheels, the intermediate, driving and trailing wheels forming the second group. The lubrication of the locomotive has received special attention. The Tecalemit system of grease lubrication is adopted for the connecting and coupling rods, motion, springs and brake gear, and Ajax grease lubricators for the coupled axleboxes. The big ends are fitted with floating bushes. The axleboxes have Franklin automatic Lubrite wedges and shoes. Connecting, coupling rod bushes and axleboxes are of Stone's bronze.

The lubrication of the cylinders and piston valves is accomplished by one Wakefield Eureka bullseye lubricator with combined steam and oil control lever, arranged on the fireman's side. The cab is of ample proportions and fitted with windows inside and louvres outside, and upholstered seats and arm rests on both sides. A Franklin wedge type radial buffer is placed between the engine and tender, and the intermediate draw bars are of the Franklin " unit " Safety type. McLaughlin flexible pipe couplings for steam and oil are provided between engine and tender.

The locomotive is equipped with a Gresham & Craven Dreadnought vacuum ejector for operating the train brake and actuating blocks on all the coupled wheels. The tender is fitted with a steam and hand brake. On the back of the cab will be noted an indicator giving the amount of gallons represented by varying indications on the oil dipper stick. The tender is carried on solid wheels (forged) made by Taylor Bros. Limited; the two four-wheel bogies have cast steel side frames and bolster. The tank capacity is 2,650 gallons, and the oil capacity 1,465 gallons. Both water and oil tanks are of Armco iron and of welded construction.

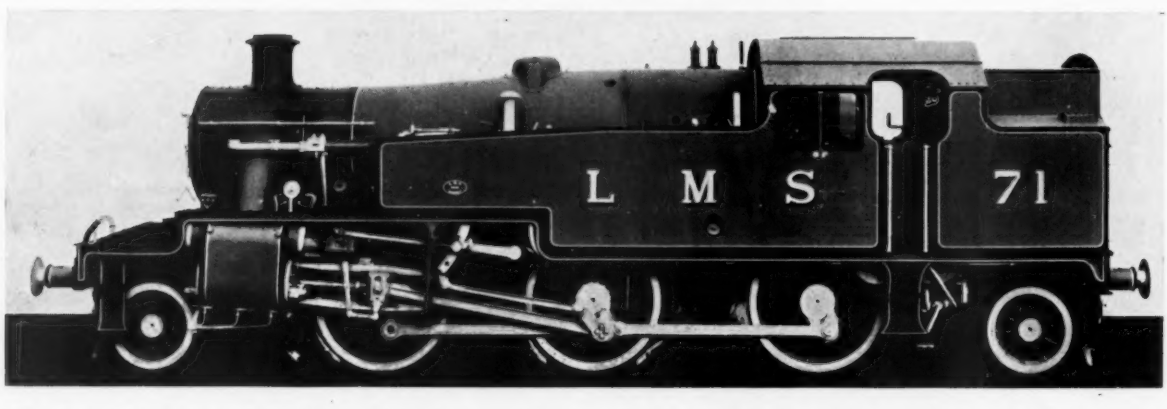
Other fittings include Visco standard Alliance automatic couplers and the Chatelier counter pressure brake. A cowcatcher is also fitted.

As the maximum lift at Callao is 40 tons, the engines have been shipped in a semi-erected condition, the frames being complete with wheels, rods and motion, whilst the boiler is a separate lift.

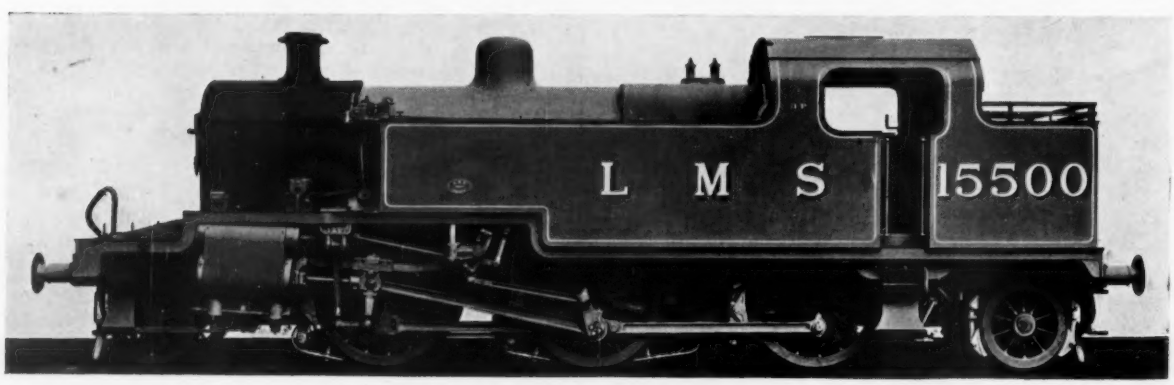
New 2-6-2 Tank Locomotives, L.M.S.R.

A comparison between the new series and the original batch of 1930

(*See article on page* 436)



The first of the new series of 20 2-6-2 *tank locomotives just completed at Derby works, L.M.S.R., which, except for the boiler, are generally similar to the earlier series of* 1930, *one of which is illustrated below*



The first of the earlier series of seventy 2-6-2 *tank locomotives, L.M.S.R., built in* 1930 *and since re-numbered*

RAILWAY NEWS SECTION

PERSONAL

Mr. Eric Coleby has resigned his position as Assistant Solicitor to the Cheshire Lines Committee on his appointment as Assistant Solicitor to the London & North Eastern Railway Company.

The Rev. H. E. Neale, who has recently been appointed to the living at Stoke Doyle, Northants, was for some time Stationmaster at Wellingborough. While a clerk in the booking office at Market Harborough he studied theology in his spare time, and became a lay preacher in that district. Upon his retirement at Wellingborough, he gave more time to his studies, and was appointed curate at Little Bowden.

At the 65th ordinary general meeting of the Board of the German State Railway Company, on February 22 and 23, the following members, recently appointed by Government, took their seats for the first time:—

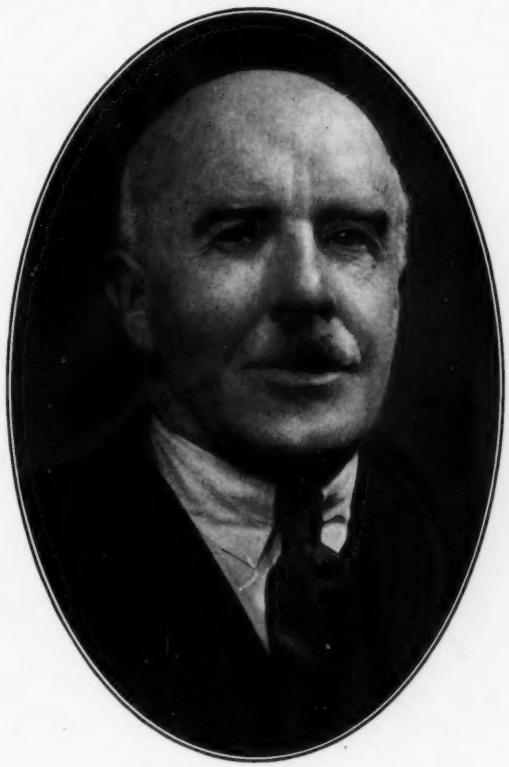
Herr Gustav Koenigs, Secretary of State, Ministry of Transport.
Rear-Admiral (retd.) Rudolf Lahs, President of the National Aviation Industry Association.
Dr. Wilhelm Ohensorje, Secretary of State, Ministry of Postal Services.
Lt.-Captain Otto Steinbrück.
Herr Herbert Stenger, Chief of the Liaison Staff of the N.S.D.A.P. (Nazi Party Organisation), and
Herr Eduard Vogel, Ministerial Director, Ministry of Transport.

The first business of the meeting was the election of Herr Koenigs and Freiherr von Schröder of Cologne as President and Vice-President respectively.

We regret to note the death, on March 1, of Mr. B. Bullock, who for many years was identified with the former London Tilbury & Southend Railway and later with the Tilbury Section of the Midland Railway. Mr. Bullock, following varied experience, became Assistant Manager of the L.T. & S. in 1893, and was promoted Manager in 1907. After the acquisition of the L.T. & S. by the Midland Railway under the Act of 1912, he continued as Manager of the Tilbury Section of the Midland, but retired from active service under the age limit in September, 1920, when the Tilbury Section was merged in the general undertaking of the Midland Railway.

Sir Robert McAlpine, second baronet, left estate valued at £386,933.

Mr. W. A. Agnew, who, as announced in THE RAILWAY GAZETTE of February 22, has just retired from the position of Chief Mechanical Engineer (Railways), London Passenger Transport Board, was born at Newton Stewart in 1874, and received his technical education in Edinburgh and Glasgow. He entered the service of the Metropolitan District Railway in 1904 and supervised the training of the staff during the introduction of electric traction. In 1908 he became Mechanical Engineer to that company, and later to the Central London, City & South London, and London Electric Railways. In the 1921 "Underground" organisations, Mr. Agnew was appointed Mechanical Engineer (Railways) in the group, becoming Chief Mechanical Engineer in 1928. On the formation of the L.P.T.B. in July, 1933, he was designated Chief Mechanical Engineer (Railways) to the Board, the position from which he has now retired. He is a member of the Institution of Mechanical Engineers and of the Institute of Transport, and was elected President of the Institution of Locomotive Engineers for 1931-32.



Mr. W. A. Agnew, M.I.Mech.E., M.Inst.T.,
Chief Mechanical Engineer (Railways), L.P.T.B., 1933–35

PRESENTATION TO MR. A. J. BRICKWELL, C.B.E.

At a luncheon at Liverpool Street, on February 28, a presentation was made by Sir Ralph Wedgwood, Chief General Manager, to Mr. A. J. Brickwell, Estate and Rating Surveyor of the Southern Area of the L.N.E. Railway. The presentation took the form of a gold dress watch inscribed "'Brickie' from Officers of the L.N.E.R.," and a pair of diamond earrings for Mrs. Brickwell. Sir Ralph referred to Mr. Brickwell's long service of more than 48 years with the Great Northern and the London & North Eastern Railways, and the invaluable work he had performed in charge of the Estate and Rating Department, culminating with the decision recently obtained in the courts under the Railway Rating Act. Apart from the honourable record he had set up in the sphere of work he was responsible for, Mr. Brickwell had found time to devote part of his energies to supporting various branches of sport, having been one of the founders of the Great Northern Athletic Association, and in later years Chairman of the Managing Committee. His retirement now was the cause of general regret to his colleagues, who desired to present him with a token of their esteem, accompanied by most cordial wishes for his future welfare and happiness in the years of leisure he had earned so well. Mr. G. F. Thurston, Divisional General Manager, in supporting Sir Ralph's remarks, stated how much he had appreciated the assistance Mr. Brickwell had at all times afforded him and officers of the company in connection with railway estate and other matters, where his unsurpassed knowledge had proved of the greatest value, and he expressed the hope of all present that one who had become so much an institution in their midst would enjoy good health and the best of luck in the future, and be successful in whatever new directions his energies were applied. Mr. Gresley and Mr. Selway also spoke in reminiscent vein of their long and happy relationships with Mr. Brickwell dating back to pre-war times. Mr. Brickwell, in responding, stated how greatly he appreciated the honour the gathering conferred upon him, and how much the generous gifts of his brother officers would always be prized by him and his wife. He had keenly enjoyed

(*Continued on page* 449)

XUM

Great Western Railway

Centenary Film

As Sir Robert Horne announced at the annual general meeting last week: "On August 31, 1835, the Great Western Railway Company was incorporated. This great organisation, of which those assembled here today are the modern representatives, is therefore within six months of completing a public service extending over the most remarkable century of human progress known to history (hear, hear). During this epoch the company has experienced periods of vicissitude as well as of good fortune: of acute anxiety as well as serene confidence: of exasperating failure as well as encouraging success: but through all those times, good and ill, the reputation of the railway has stood high in popular favour and we are today the heirs of a system which absorbs our interest and commands our loyalty."

Amongst other celebrations in commemoration of the centenary of the only British railway company which has preserved its original name and identity for 100 years, will be a sound film depicting the inception, promotion and history of the Great Western Railway. Directors, officers and prominent citizens of Bristol have already become amateur film actors for the preparation of the opening scenes.

On this page we publish two photographs, taken on a recent Sunday, outside the Merchant Venturers' Hall at Bristol.

Photos by] [Western Daily Press and Bristol Mirror

Railway directors as film actors—Scenes at Bristol at the making of the G.W.R. centenary film

Left to right: Mr. Bryan Powley; Sir Watkin Williams-Wynn, Bt., C.B., Director, G.W.R.; Mr. F. R. E. Davis, Secretary, G.W.R.; Mr. Chas. J. Hambro, a Deputy Chairman, G.W.R.; Miss Flora le Breton

(*Continued from page* 447)

his career on the railway, some of the happiest years of which had been passed since the amalgamation, and he had been only too glad to co-operate in the team work that had been such a marked feature under the leadership of Sir Ralph Wedgwood and successive Area Managers. He now carried away the happiest recollections, and would continue to hope for the success of the undertaking he had spent his life with, and also maintain as close an interest as possible in the Athletic Association that had always been so near his heart.

Brigadier - General Sir Arthur Maxwell, a Managing Partner in Glyn, Mills & Company, whose death we announced in our issue of January 25, left estate valued at £58,294 (£38,787 net).

M. Kaganovitch has been appointed Commissioner of Railways in the U.S.S.R. His appointment is considered as the signal for a closer supervision and general stirring up of the whole railway organisation, which is recognised as clogging the wheels of progress in the Republics by its laggardliness. M. Kaganovitch has won esteem by his excellent work in completing the Moscow Underground line so rapidly.

It is with regret that we have to announce the death, on March 3, of Mr. R. G. Grant, who for the past five years has been Secretary of the Bengal-Nagpur Railway Company. Previously he was for 29 years in the Audit Department of the railway in India, in which he rose to be Chief Auditor prior to his retirement to take up the post of Secretary in London. He served during the war in France and Mesopotamia as a Lieutenant in the 6th East Lancashire Regiment.

Mr. A. E. Rogerson, of the Chief Mechanical Engineer's headquarters staff at King's Cross, L.N.E.R., retired from the company's service on March 5. Mr. Rogerson joined the office of the Locomotive Accountant, Doncaster, Great Northern Railway, in 1896, and remained there until the amalgamation in 1923, when he was transferred with Mr. Gresley's office to King's Cross. On February 21 his colleagues presented him with a silver coffee service, and enamelled-silver dressing table set for Mrs. Rogerson. In making the presentation, Mr. Gresley paid tribute to Mr. Rogerson's qualities, and thanked him for the able assistance he had always so loyally given. Mr. E. Thompson, Mechanical Engineer, North Eastern Area; Mr. S. Groom, Locomotive Running Superintendent, Southern Area; Mr. H. W. H. Richards, Electrical Engineer, and other officers also spoke in appreciation of Mr. Rogerson, who suitably responded.

The Institution of Locomotive Engineers

All previous records for attendance were broken when 280 members and guests sat down to the 1935 dinner of the Institution of Locomotive Engineers, held on Friday last at the Trocadero Restaurant, London, W.1. Mr. H. N. Gresley, Chief Mechanical Engineer, L.N.E.R., and President of the Institution of Locomotive Engineers for the year 1934-5, occupied the chair, and those present included:—

Mr. W. A. Agnew, Lt.-Col. R. D. T. Alexander, Messrs. Bachellery, W. J. Bassett-Lowke, Capt. G. S. Bellamy, Messrs. L. G. Bigg-Wither, A. F. Bound, H. Leslie Boyce, A. J. Boyd, O. V. Bulleid, A. C. Carr (President-nominate session 1935–36), H. Chambers, A. H. Chilton, J. Clayton, Lt.-Col. F. R. Collins, Messrs. W. Damer Dawson, W. S. Edwards, W. S. Every, C. E. Fairburn, Lt.-Col. J. G. Fleming, Messrs. V. P. Gamon, P. L. N. Ghilain, C. N. Goodall, W. S. Graff-Baker, E. H. Greg, S. R. Gresham, S. T. Gresham, Ranald J. Harvey, C. G. Hatherley, Sir Brodie H. Henderson, Messrs. C. W. C. Hine, H. Holcroft, T. Hornbuckle, W. G. Hornett, P. A. Hyde, A. D. Jones, Lancrenon, L. J. Le Clair, Prof. G. V. Lomonossoff, Brig.-Gen. Sir H. O. Mance, Messrs. J. Masterton, J. C. Metcalfe, H. J. Moyses, N. D. MacDonald, W. G. P. Maclure, Col. The Hon. Angus McDonnell, Messrs. Nasse, I. K. F. Pearson, K. R. Pearson, W. Redpath, M. Renevey, R. A. Riddles, Capt. E. A. Robinson, Messrs. C. R. Salmon, T. H. Sanders, H. G. Shortt, Sir John Siddeley, Messrs. T. L. Squires, W. A. Stanier, Col. H. A. Stenning, Messrs. R. A. Thom, W. B. Thompson, G. Thomson, J. S. Tritton, Dr.-Ing. eh R. P. Wagner, Messrs. W. J. Wakley, W. L. Watson, Major Bruce G. White, Messrs. W. Whitelaw, R. H. Whitelegg, Major Charles Williams, Mr. W. Cyril Williams and Mr. S. J. Young.

Following the loyal toast proposed by the President, Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R., proposed "The Guests," coupled with the names of Mr. William Whitelaw, Chairman, L.N.E.R., and M. Bachellery, Chief Mechanical Engineer, Paris-Orleans-Midi Railways. They were very pleased, he said, to have with them that evening M. Renevey, Manager, L'Office Central D'Etudes de Matériel de Chemins de Fer, Paris; M. Lancrenon, Chief Mechanical Engineer, Northern Railway of France; M. Nasse, Chief Mechanical Engineer, French State Railways; M. P. L. N. Ghilain, an Engineer-in-Chief (Loco. Running), Belgian National Railways, and Secretary-General, International Railway Congress; Dr.-Ing. Wagner, German State Railway; and Col. J. G. Fleming, Fourth Crown Agent and Engineer-in-Chief, Crown Agents for the Colonies.

M. Bachellery, responding on behalf of the guests, said it was always a great pleasure to come over and meet friends on this side of the Channel. He recalled happy times enjoyed here during the International Railway Congress held in London in 1925, and the Centenary Celebrations of the first public railway in England also held at that time. While this country had been the pioneer in the making of railways, he said that Marc Seguin, who built the first French railway, ordered two locomotives from the Stephensons, and subsequently improved locomotive design with the multitubular boiler, which Stephenson later adopted for the *Rocket*. He noted that at Vitry, where Mr. Gresley's *Cock o' the North* engine had recently undergone tests, certain British-made items of equipment were to be found. Similarly in Mr. Gresley's engine were to be found features derived from the work of French engineers, and Mr. Gresley, he thought, had also learned something from the French tests.

Mr. Whitelaw, proposing the toast of "The Institution of Locomotive Engineers," said the institution was progressing in a way he should like to see some of our railway companies doing also. They had learned a great deal about efficiency of steam locomotives and running shed organisation from their French friends. They had learned also much from their friends in Germany, resulting in their having adopted the Frölich railbrake on the L.N.E.R. with such excellent results. They were narrowing down rail traction problems, and while for the moment they had put main line electrification aside, their chief problem was the development of the steam locomotive fired with native fuel, namely, coal. In this country they suffered from being pioneers in railways and having a great deal more interference from Government than any other nation. The necessity of providing platforms at stations, and like restrictions, placed definite limits on train lengths, apart from locomotive performance. Their problem was not so much how to increase locomotive power as to obtain the maximum power with the maximum economy. He concluded by paying tribute to the great service the President had rendered to the development of the steam locomotive.

Mr. H. N. Gresley, replying to the toast of the Institution of Locomotive Engineers, thanked Mr. Whitelaw for his reference to what he had attempted in locomotive design. The institution was founded in 1911, in the year Mr. Gresley became Chief Mechanical Engineer of the G.N.R. The silver jubilee of the institution would consequently be celebrated during the year of office of his successor. During his presidency in 1928 they had a record gathering of 105 persons at the annual dinner. Last year that had risen to 244 and he was very proud this year to know they had increased the attendance to a figure of 280. Mr. Gresley, speaking in French, acknowledged the assistance rendered by his French colleagues during the recent tests of the *Cock o' the North*. With regard to these tests, Mr. Gresley said they had had some trouble with the engine at first, but she was subsequently run on the open line hauling three brake locomotives and attained a speed of about 80 m.p.h. Further engines of the *Cock o' the North* type would be modified as a result of the tests.

XUM

SOUTHERN RAILWAY COMPANY

Record passenger traffics—Operating efficiency—Extension of air transport—Dover-Dunkirk train ferry—Successful rating appeal

The annual general meeting of the Southern Railway Company was held at Southern House, Cannon Street station, E.C.4, on Thursday, February 28, Mr. Robert Holland-Martin, C.B. (Chairman of the company), presiding.

The Secretary (Mr. F. H. Willis) read the notice convening the meeting.

The Chairman said:—

Ladies and gentlemen, I assume you will take the report and accounts as read. At our last annual meeting Mr. Gerald Loder, now Lord Wakehurst, occupied this chair, and gave a most interesting and clear account of the revenues and expenditure of the line in 1933. In June last we were all delighted to find his name in the Honours List as the recipient of a peerage for services rendered to the State, and many of us wrote wishing him health and happiness.

Unfortunately he became unwell in the autumn, and deciding that his work as Chairman was proving too exacting he asked to be relieved of that office to which he had devoted so much of his time and energy. We hope soon to see him return to our Board and Committees so that we may once more enjoy the benefit of his long experience in railway affairs. I would remind you that he became a Director of the L.B.S.C. Railway in 1896.

Last year he told you that in 1933 the downward trend of our traffics had been arrested, and today I am glad to inform you that the working of your railway during 1934 shows that we are climbing again, slowly it may be, but I hope surely towards the point we reached in 1929 when we were able to make a distribution of 2½ per cent. on the holdings of the deferred ordinary stockholders. I need hardly assure those stockholders that we appreciate their unfortunate position and sympathise with them in their lack of dividend which it is one of our chief ambitions to restore.

I now propose to run briefly through the accounts, drawing your attention to the more important items:—

Capital Expenditure

Our capital expenditure account includes a new item "Subscriptions to Road Transport Undertakings," £546,000. This represents our proportion of the cost of the railway companies' purchase of the undertakings of Carter Paterson and Hay's Wharf Cartage Company. The amount of capital expended during the year was £1,728,000, which includes, in addition to the item of £546,000 for the purchase of the undertakings I have just referred to, £644,000 for "Electrification," and £549,000 in connection with the extension of our docks at Southampton.

Passing to the revenue account, you will be pleased to notice that our net receipts from railway working for the year as compared with 1933 show an increase of rather more than £270,000, or 6·72 per cent. Gross receipts were higher by £523,000, to which passenger train traffic contributed £296,000, goods train traffic £215,000, and miscellaneous receipts £12,000. Railway expenditure increased by £253,000. You will observe that rather more than 51 per cent. of the increase in gross receipts has been retained as net revenue.

Dealing first with passenger train traffic, you will remember that in 1933 we recorded an increase in our carryings of 7,000,000 passengers as compared with the number carried in 1932. It is very satisfactory to be able to report that in the year under review the number of passengers carried further increased by no less than 13,600,000. The total number of journeys, including those of season ticket holders, was approximately 338,000,000. This creates a record for the company. Our previous highest was 330,000,000 in 1930. Of this increase of 13,600,000 passengers, no less than 11,000,000 were carried on those sections of the line that have been electrified. The total receipts from passengers on the electrified lines advanced by £302,000.

The electrified lines are, as you know, mainly within the suburban area, and any increase in net revenue from passenger traffic within that area is now divisible with the London Passenger Transport Board and the other main line companies through the medium of the London Passenger Transport Pool, to which I shall refer later.

Success of Summer Tickets

The issue of Summer tickets, to which reference was made at our meeting last year, was continued throughout the whole of 1934, and undoubtedly proved of benefit to the stockholders as well as to the travelling public. One of the effects of these cheap tickets was that we recorded an increase in the number of passengers travelling between London and nearly every one of our seaside resorts. Incidentally, the issue of these tickets brought about for the first time in many years an increase in the number of our first class passengers.

Goods train receipts are higher by £215,000. The improvement was general throughout all classes of traffic, except livestock. The total tonnage carried increased from 16,233,000 in 1933 to 16,849,000 in 1934, and the average receipts per ton advanced by one halfpenny from 5s. 9·32d. to 5s. 9·85d.

The Kent collieries put on rail 1,800,000 tons of coal, of which we ourselves took about one quarter for locomotive and other purposes. I am sure you will be interested to know there has been a steady growth in the output of the Kent collieries each year since 1927.

Lower Operating Ratio

Turning now to the expenditure, the increased cost of railway working was £253,000, as already mentioned. This can be mainly attributed to two causes: first, increased traffic, and, secondly, the return to normal expenditure on certain items which were somewhat drastically cut down during the periods of extreme depression in 1932 and 1933.

The three principal items of expenditure showing increases are: maintenance of way and works, locomotive running expenses, including cost of electric traction, and traffic expenses. None of these, however, calls for special comment, and I would point out that the ratio of total expenditure to total receipts is lower than in 1933. I will just mention in passing the interesting fact that, compared with 1930, our total expenditure for last year shows a reduction of £2,300,000.

You will notice that the amount under the headings of "Rates" and "Railway Freight Rebates Fund" remains the same as for 1933. I shall refer to this subject again in a moment.

While the receipts from our ancillary businesses increased by £31,000, expenditure on these businesses also increased by £54,000, due mainly to an advance of £36,000 in the cost of collection and delivery of parcels and goods, brought about partly by the higher scale of licence duties, and partly by the larger volume of traffic dealt with.

There is one other matter concerning our ancillary businesses to which I would call attention. You will observe that under the heading of "Air Transport," which for the first time appears in our accounts, we show that receipts amounted to £272, and expenditure to £5,042—a debit balance of £4,770. These figures, however, call for some more detailed explanation.

During the year we became interested in two different air services. In one, where we co-operated with the Great Western Railway in providing a service in both directions

between Birmingham, Bristol, Portsmouth, and Cowes, our associated air transport company was unable to obtain delivery of the necessary machines until well into the month of July, and the service was, therefore, in operation for only about two months, the loss amounting to £900.

The second service in which we took an interest was one of the two services flying between London and the Isle of Wight. In providing this service we entered into an arrangement with the Spartan Air Lines whereby we were to receive half the profits or pay half the losses. This experiment cost us £3,200, and our contribution of that amount is shown on the expenditure side of the accounts, nothing, of course, being included under the heading of receipts. Both these services were undertaken as experiments.

Air Transport Developments

As mentioned to you at our meeting last year, our company, in co-operation with the other main line railway companies and Imperial Airways, had decided to make the necessary arrangements for providing such air transport services as we and the other railway companies might think fit to establish, and in pursuance of these arrangements we worked both the services I have referred to through the medium of Railway Air Services Limited, a company formed by the four main line railway companies and Imperial Airways for such a purpose, and as a co-ordinating unit for all necessary and proper aerial development by the main line railway companies.

There can be no doubt that if railways are to share in the increasing traffic by air, their activities in aerial transport will, as time goes on, have to be considerably extended. It is to this end that we, in co-operation with the Great Western Railway Company, are taking a financial interest in another company whose forerunner successfully operated a regular service to Jersey last year.

You will, of course, realise that in its early stages this development by air cannot be expected to be conducted except at a loss. But if we aim at that standard of safety, comfort and reliability which the public is entitled to expect from a main line railway company, I think we have every reason to believe that transport by air, properly conducted and regulated, will in time become a paying proposition. I feel sure you will agree that it is necessary that we should seriously apply ourselves to this form of transport, and thus protect our important cross-Channel and other interests as far as we possibly can by every reasonable and proper expansion of this alternative transport facility.

Having now reviewed the receipts and expenditure of the railway and ancillary businesses we find ourselves with an increase in the net receipts from these sources of £248,000. The net receipts from rents, interest and Government grants rose by £24,000, but there was a slightly heavier loss by £4,000 on the Somerset & Dorset Joint Line, and the charges for interest on superannuation funds and other miscellaneous charges were higher by £7,500. On balance, therefore, we had a return from these items of £12,500 more than in 1933, and the net revenue for the year amounted to £5,800,335, an increase on the previous year of £260,538, or 4·70 per cent.

Increase in Dividend

After taking into account the difference in the amount brought forward, the final result is that we have £278,000 more available for dividend on our ordinary stock. This will admit of an increase in the dividend on our preferred ordinary stock of 1 per cent., that is to say from 3 per cent. to 4 per cent., the carry forward being slightly increased from £225,000 to £227,000.

In the report a reference is made to our proposed train ferry service between England and France. We had expected to have the service in operation between Dover and Dunkerque by the summer of 1935. I regret, however, that owing to the very serious and unforeseen difficulties experienced in the carrying out of the work at Dover due to the appearance of a small fissure in the chalk entirely outside the experience of any geologist, this expectation will not be realised, and there is no prospect of our being able to commence the service until early in 1936.

Train Ferry Service

Arrangements have been completed with the International Sleeping Car Company for the running of a through service of sleeping cars between London and Paris, thus providing a means whereby a passenger can leave either capital after dinner or the theatre, sleep undisturbed till he arrives at breakfast time in London or Paris, with the whole day before him for work or play. He can return similarly the next night. By this means, since their double journey will be less tiring, we hope to gain back some of those passengers we have now lost to the air. This, however, is not the main object of our ferry service. The establishment of a ferry service was decided upon after consultation with our railway friends on the other side of the Channel in order to meet, amongst other requirements, the continued demands of the growers of fruit and vegetables in France, Italy, and Spain for better facilities, with the minimum of handling, for the conveyance of this highly perishable traffic.

We have been considerably handicapped in holding this particular traffic through the want of these better facilities, and there is no doubt that if we had not decided to provide them we should have lost the greater part of this remunerative business.

You will gather from the report that the new works at Southampton Docks have made good progress. The whole of the new quay, 7,000 feet in length, has been completed; four of the eight sheds have already been taken over for traffic purposes, and the other four sheds will be brought into use this year.

Owing to the general depression in the shipping industry, there has naturally been a reduction in the number of ships entering and leaving the port, and, further, as a result of the action of the shipping companies in reducing their expenditure, we have experienced a considerable falling off in the number of ships making use of our dry docks for general overhaul. Nevertheless, there have been compensating advantages. The tonnage of merchandise imported and exported expanded by no less than 47,000 tons. There was a slight increase in the number of passengers in and out, but a decrease in the number of troops passing to and from England and the various depôts overseas.

Progress at Southampton

Amongst other compensations, we have had a very large increase in the fruit traffic. Southampton received 5½ million packages of South African fruit during the year, this total representing an advance of nearly 20 per cent. on the 1933 figure.

Elders & Fyffes' steamers engaged on the Central American and West Indies service brought a record quantity of 1,850,000 bunches of bananas to the docks—an increase of 17 per cent. This trade could not have been secured to Southampton had it not been for the excellent accommodation we have provided for dealing with it.

In November last we had the pleasure of a visit to our docks at Southampton from the Agents-General for Victoria, New South Wales and Tasmania, and the Official Secretary to the Commonwealth of Australia, and as a result of their inspection we have every reason to expect a large expansion in the Australian trade in the near future. Southampton remains the premier passenger port of this country for overseas travellers, and we are quite confident that in the course of time its position as a cargo port will be very much enhanced.

The new area which we have gained from the foreshore is gradually consolidating, and we hope soon to see new factories and works rising on the reclaimed area. Our first tenants, Joseph Rank Limited, have now completed the first stage of their mill, and their steamers arrive and discharge their corn on endless belts from ship to silo. Fifteen thousand tons—for that is what the silo contains—is a heavy load for a new building on made ground, but the weight is so well distributed on piles that the building shows no sign of movement.

I will now return to the subject of rating. The four main line companies have for some time held the view that the assessments upon which they have been paying rates were much too high, and in this connection they gave

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evidence before the Railway Rates Tribunal as long ago as November, 1931, to the effect that in their considered opinion the assessments would be substantially reduced when the undertakings were re-valued under the Railways (Valuation for Rating) Act, 1930. Under this Act the railways are now to be valued *in cumulo* instead of parochially as in the past, and in accordance with the Act we had to submit our accounts to the new Railway Assessment Authority established under the Act in order that it might carry out its functions and assess the figure at which our undertaking should be rated for a period of five years as from April 1, 1931.

Rating of the Railway

After much unavoidable delay the authority fixed the net annual value at £2,180,000, this figure comparing with our previous net annual value of approximately £1,840,000. We were dissatisfied with this assessment and lodged an appeal, and our appeal, which lasted for 16 days, has recently been heard by the Court of the Railway and Canal Commission. The unanimous decision of the three members forming that court was that the net annual value, as fixed by the Railway Assessment Authority, should be reduced to £1,077,131, approximately 50 per cent. of the amount fixed by the authority, and the court ordered that our costs should be paid by the Railway Assessment Authority.

The shareholders will perhaps expect me to give them some indication of the anticipated saving to the company resulting from the reduced assessment—this, of course, always assuming that, in the event of an appeal, the recent decision in our favour is upheld by the House of Lords. It is impossible to forecast these figures exactly. I may say, however, that the total amount we have been paying during the last year or two under the head of "Rates" and "Railway Freight Rebates Fund" is about £770,000 a year, so that a simple calculation will show that if this is the sum paid in respect of a net annual value of £1,840,000 the sum to be paid in respect of a net annual value of £1,077,000 would be about £450,000, a reduction of £320,000. In practice it may not work out quite like this, and I therefore put the estimated saving at about £300,000 a year.

There will also be a considerable sum due to the company representing our overpayments in respect of the period since April, 1931, but here again it is impossible to say when this will be recovered. One quarter of the sum has been paid to the local authorities and three quarters to the Railway Freight Rebates Fund and distributed through that fund in rebates to the traders. It is obvious that neither sum can be paid back at once, but I can assure you that the matter will have our very special attention.

Before I leave this subject, I want to say that in the opinion of your Directors this highly technical and very important appeal was prepared and presented to the court on the company's behalf in a most able manner. We are indebted to our Counsel, our Solicitor and our other officers, and also to the officers of the other main line companies, for the great assistance they rendered us in this matter.

London Transport Pool

In his speech to you last year Lord Wakehurst referred at some length to the London Passenger Transport Act which received the Royal Assent in April, 1933, and he mentioned that the Standing Joint Committee set up under the Act and composed of the General Managers of the four main line railway companies and representatives of the London Passenger Transport Board were preparing a pooling scheme in accordance with the provisions of the Act. The scheme is required to provide for the pooling in the manner prescribed by the Act, of the whole of the passenger receipts of the London Passenger Transport Board, and the receipts of the four main line railway companies from passenger traffic local to the London Passenger Transport Area. This scheme was recently completed by the committee and approved by the London Passenger Transport Board and the four main line railway companies, and it has now been submitted to the appointed tribunal for confirmation.

When I tell you that under the scheme we are entitled to rather more than 25 per cent. of the net receipts of this pool, you will appreciate how vitally your interests are affected in the London passenger traffic as a whole. As Lord Wakehurst informed you, we have every reason to believe this Transport Act, with its pooling scheme, will prove of advantage to the travelling public in the direction of improved services and of advantage to the stockholders in the avoidance of wasteful and unnecessary competition.

Now a word as to our relationship with our staff and the trade unions. In January, 1931, consequent upon the very serious fall in revenues, the railway companies applied to the National Wages Board for a reduction in the salaries and wages of their employees. As a result, and as you are aware, the salaries and wages of all grades of the service have been subject to certain percentage deductions since March in that year. These deductions, subject to certain minima and modification in the case of workshop and certain other of our employees, were 2½ per cent. on all earnings, with a further 2½ per cent. on earnings in excess of 40s. per week. Beyond this, certain relief was obtained by the companies in a revised basis of payment for Sunday duty, overtime, and night work.

Agreement on Wage Cuts

Early in 1934 the trade unions applied to the companies for a discontinuance of these percentage deductions on the ground that our receipts were showing an upward trend, and that the wages cuts had been restored in the case of the men in Government and local authority employment, as well as in a number of other industries throughout the country.

After prolonged discussions the companies and the unions agreed in August last to a discontinuance of the second part of the percentage deductions, that is to say, the 2½ per cent. on earnings in excess of 40s. per week—the arrangement being that 1¼ per cent. should be restored as from October 1, 1934, and the other 1¼ per cent. from January 1, last. The present position therefore is that, subject to certain minima in the case of the lowest paid staff, a deduction of 2½ per cent. is now made from the earnings of the staff generally.

Your Board was satisfied that these concessions were in the best interests of the shareholders, and they have no reason to depart from that view. The fact that the concessions were made in anticipation of a continuance of improving traffics, which has not yet been fully realised, in no way affects the soundness of the decision we then formed, but any question of giving further improvement in wage conditions must, of course, be postponed until a more definite stage in the progress of industrial recovery has been reached.

New Negotiating Machinery

While on the subject I am sure every stockholder must have been pleased at the announcement in the newspapers that an agreement had been signed between the railway companies and the unions in regard to the setting up of a new scheme for the determination of differences in regard to rates of pay and conditions of service. Whereas the old scheme was a statutory one, the Central and National Wages Boards having been set up by the Railways Act of 1921, the new scheme is one set up by agreement between the parties themselves. It eliminates many of the features to which objection was taken in the previous scheme, and introduces a more suitable procedure, which we trust will enable negotiations to be carried out in a more satisfactory way than under the former arrangements.

The success of any business depends on the service that it is able to give, and that it does give to its customers, the public; and no service can be efficient that is not rendered freely and whole-heartedly by a staff each one of which is proud of belonging to the company he serves and determined to make that company a success. Such a staff have we on the Southern Railway, and on your behalf as shareholders and on my own I thank each and all of them from the General Manager and his able staff to the youngest member of the uniformed staff and the shop boy in our many works for the ungrudging and loyal service that they give to our great railway.

And I look to you, the shareholders, to play your part, too, by bringing its merits, its many services, and its unique holiday resorts to the continuous notice of the British public.

If we pull together in this way, our progress to recovery will be faster and surer ever than it has been.

I now beg to move that the report of the directors and statement of accounts for the year 1934 be and the same are hereby received and adopted.

The Deputy-Chairman (Mr. Eric Gore-Browne, D.S.O.) seconded the resolution.

Shareholders' Remarks

Mr. H. Leslie Boyce, M.P., was sure that all the stockholders would like to associate themselves with the Chairman in offering congratulations to Lord Wakehurst on the dignity of the Barony which had been conferred upon him, and with the hope that they might have the benefit of his services as a director for many years to come. He believed it was true to say that at this time last year this was the only important railway company in the world to pay a dividend on any class of ordinary capital entirely from profits actually earned during the preceding year. He would like to ask whether the whole of the increased dividend and carry-forward had been actually earned during the past year without recourse to reserves of any kind. The result of the directors' bold policy of electrification was that today the company had the largest suburban electrified system in the world, and financially the most successful. Possibly the Chairman could tell them when the extensions now in hand would be opened for traffic. Another striking instance of foresight was the policy being pursued in the development of the docks, particularly at Southampton. The company had also been wise in acquiring a substantial interest in those companies which operated air transport between the mainland and the Isle of Wight and the Channel Islands respectively. He was sure that the stockholders as a whole were satisfied that the agreement as to wage deductions was in the best interests of the company. There were ways in which the shareholders themselves could help in securing traffic for the railway.

Sir Waldron Smithers, M.P., also wished to congratulate the Board on its policy. He had seen in the rapid growth of his constituency some of the striking results of electrification, and he gave instances of the constant readiness of the company's officers to meet genuine complaints properly put forward.

Commander Inglefield thanked the Chairman for the courtesy extended during the past year to the suggestions made by the British Railway Stockholders' Union, and for allowing the question of reduced fare facilities for stockholders attending the annual meetings to be brought forward at this meeting.

Mr. Plant suggested that the company should pay more attention to advertising in the northern suburbs and to explaining to residents therein how to get to the company's main London departure stations.

Mr. Leaman asked for the abolition of the restriction on the use of single-fare tickets to the Kent Coast and the South West to trains leaving London at or before 11 a.m., and that certain differences in season ticket rates and between rail and bus fares in the Sittingbourne district should be inquired into. He also suggested that a slight alteration of the layout at Sittingbourne would remove the delays now caused by the Sheerness branch trains.

Mr. Hooper pleaded for cleaner and brighter stations.

Mr. Greig suggested that the paint on the rolling stock should be entirely altered, by adopting "Caledonian" blue for the engines, and the old London & North Western colour, maroon and white, for the carriages.

Mr. Glennie asked whether the Chairman could make any remarks about the last 8 weeks' traffic.

The Rev. M. Pearson complained that many of the carriages on the electric trains were unheated.

Mr. Parkinson asked what was the radius of the area for the pooling arrangement with the London Passenger Transport Board.

Mr. Hamblin advocated splitting up some of the company's stocks, instancing the deferred ordinary stock, into units of £1 so as to enlarge the number of shareholders.

Mr. Williams thought that the company's advertisements should emphasise more clearly that it was the "Sunshine" line.

Mr. Watford called attention to the fact that the numerous changes and improvements had been brought about without interfering with the normal working of the line.

Mr. H. W. England alluded to the agreement with the railway unions as to wage cuts and to the new negotiating machinery.

Chairman's Reply

The Chairman (who was received with acclamation): Well, ladies and gentlemen, I thank you very much for the very kind way in which you have greeted my first appearance here today, and I thank the various speakers for the remarks that they have made. Sometimes we have had useful and helpful remarks from our Stockholders. I should particularly like to thank Mr. Leslie Boyce for the remarks he made. He asked whether our increased dividends and increased carry-forward had been fully earned this year. Well, I can assure him that indeed they were, and that they were earned from the direct earnings of the railway company. (Applause.) He also asked when the new electric extensions would be opened. We hope to open the Eastbourne extension early in July, and one of the London connections in the early autumn—probably at the beginning of October. I am also thankful to Mr. Boyce for further emphasising what I said to the shareholders with regard to the way in which they can help to give the line a "shove" themselves, and if they will only do what he suggested, and send a postcard to our Traffic Manager, Mr. Cox, I am sure it will be met with every possible appreciation and we shall be very grateful.

I welcome Sir Waldron Smithers today, not only because he is the son of an old Director of this company, but also because I want to thank him for the congratulations he has given us on the working of the line, and his statement, which I am sure is the experience of all of you, that our officers are always unfailing in their courtesy.

Commander Inglefield raised the point that the Stockholders' Union would like special cheap fares given for stockholders to attend the meetings. That is an almost impossible request to make. First of all, it has to meet with the agreement of all the other lines, because you must recognise that our shareholders do not live on one line alone, and we should have to ask other lines to send people right from the North of England and Scotland. What is more, if many of them availed themselves of it, in what place in London would you hold the meetings? Even now you have to give your Chairman an amplifier! I do not know what place you would have to take in which to hold the meetings if that suggestion was adopted. I told Commander Inglefield that I was quite willing for the resolution to be put to the meeting, but I would assure him that the matter has had very serious consideration—it has often been brought up before—and I would ask him not to press it.

Then Mr. Plant, who lives on the Great Northern, tells us that he does not see a sufficiency of our advertisements there. Well, I hope that we may be able to alter some of that; but I would say that we are already spending more than £40,000 a year in advertising in different places, and all the time we are trying to see that those advertisements are put in places where they will help the line most.

Then with regard to Mr. Leaman, who came from Sittingbourne, we are very glad to hear how he finds the improvements on the East Kent line and that they are giving great satisfaction. He put forward one or two suggestions. We will look into those and see if anything can be done with regard to them.

Then Mr. Hooper and other speakers expressed the wish that we should do something in the way, as I understand it, of brightening up our railway stations. He spoke of making the staff more proud of their railway stations. We hope to do that; we hope to make the stations very much brighter places; we hope to make the waiting rooms places where anyone can wait for a train and enjoy the waiting. I am afraid that at the moment they very often fail in that because they are too cold and too dark. But that is a matter we are giving very great attention to, and I hope that by the time we meet next year we shall have a brighter line to show you.

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Mr. Greig spoke about the colours of the trains and brightening up the rolling stock. Our experience of paints is this: every paint which is used is tested very thoroughly. We are always testing paints and seeing that they do have a really good staying-power. This particular colour he would like us to adopt, blue, has proved in the railway world to be the most expensive of all colours. Anyhow, we will try and get our greens a little brighter.

Mr. Parkinson asked us about the radius of the pool area. That is roughly some 25 miles from Charing Cross.

Mr. Hamblin suggested that some of the stock might be split up. There were suggestions some time ago about that and they were turned down. Personally I cannot see any great advantage in doing that at the present time.

I can assure Mr. Williams that we will see that the advertising is well done, and we will let people know that ours is the "Sunshine" line. We already do, because there are many places up and down the line advertising the sunshine. We get the sunshine places from the Meteorological Office, and 60 of the most sunny spots are on the Southern Line. But I can assure him that we will do more publishing of the fact that we do have plenty of sunshine on our Line. I was glad to hear what Mr. Watford had to say, and I can assure Mr. England that we will bear in mind what he has said today.

I will now put the resolution to the meeting.

The resolution was put and carried unanimously.

The Chairman then moved the following resolution:—"That the following dividends be and the same are hereby declared:—For the half-year to December 31, 1934: 2½ per cent. on the 5 per cent. guaranteed preference stock; 2½ per cent. on the 5 per cent. redeemable guaranteed preference stock (1957); 2½ per cent. on the 5 per cent. preference stock; 2½ per cent. on the 5 per cent. redeemable preference stock (1964) (making in each case with the interim dividends, 5 per cent. for the whole year); 4 per cent. on the preferred ordinary stock for the whole year; and that such dividends be payable (subject to income tax) on March 5, 1935."

Mr. Eric Gore-Browne seconded, and the resolution was put and carried unanimously.

Mr. Eric Gore-Browne proposed the re-election of the retiring Directors, Mr. Robert Holland-Martin, Sir Charles L. Morgan, Mr. F. Dudley Docker, the Rt. Hon. Lord Ebbisham, Sir John E. Thornycroft, and the Rt. Hon. L. S. Amery, M.P.

Lord Rockley seconded, and the resolution was put and carried unanimously.

The retiring auditor, Sir William Harry Peat, K.B.E., F.C.A., was re-elected an auditor of the company.

SPECIAL GENERAL (WHARNCLIFFE) MEETING

Mr. Holland-Martin presided at this meeting, which was held to consider the Company's Bill in Parliament.

The Chairman: Ladies and gentlemen, the principal objects of this Bill, as explained in the notice which has been sent to each proprietor, are to obtain powers to construct a deviation at Leatherhead of the Motspur Park and Leatherhead Railway authorised by our Act of 1930 and about to be constructed, and for the acquisition of additional lands for the purpose of that railway; to construct a short railway at Lydd, in Kent, and to abandon a portion of the existing railway at that place; to confer further charging powers upon the company with respect to the Gravesend Canal Basin, and to empower the company to raise additional capital not exceeding £7,500,000. That briefly covers the objects of the Bill.

You will probably wish me to say something in regard to the powers we are seeking to raise this additional capital, not exceeding £7,500,000. At the present time, as you will see from the accounts, the company's available capital powers amount to a little over £7,000,000; but if the amount which has been overspent on capital account is deducted from that figure, we are left with a balance of available capital powers of about £2,000,000 only, which is barely sufficient to meet the capital expenditure on the new works now in hand and contemplated. It is, therefore, necessary that further capital powers should be obtained so that we may keep our accounts in proper order, and ensure that our capital expenditure does not exceed the powers already granted by Parliament. We have accordingly included in our Bill the powers to raise this additional capital, and it is desired, if you approve, to take the new powers in the same form as those we obtained by our Act of 1932, that is to say, to authorise the new capital to be raised by the creation and issue either of new ordinary stock or new preference stock (including guaranteed preference stock) or by the issue of debenture stock. We consider that by taking the powers in this general form, and without specifying how much of the capital is to be raised in the form of ordinary or preference or debenture stock, we shall be enabled to raise the additional capital to the best advantage of the proprietors having regard to the position generally at the time when the money is required.

And I would here take this opportunity of assuring every stockholder that before any capital expenditure is sanctioned, its purpose is carefully examined to see whether it is likely to bring into the common purse of the company more revenue than will meet the interest charges. If it will not pass this test the expenditure is not sanctioned. If it does, we may reasonably expect that it will produce a surplus for distribution to the ordinary stockholders.

You will have gathered from what I have already said that we shall not need to exercise these additional capital powers for some time to come, and you will, of course, understand that it will be necessary to obtain your sanction at some future general meeting before the powers can be exercised.

The Chairman then moved the following resolution:—"That this meeting, having considered the Bill intended to be presented to Parliament, intituled, 'A Bill to empower the Southern Railway Company to construct works and acquire lands; to extend the time for the completion of certain work and the compulsory purchase of certain lands; and for other purposes,' approves thereof with such modifications (if any) as may be agreed to by the Directors and sanctioned by Parliament."

The Deputy-Chairman (Mr. Eric Gore-Browne) seconded, and the resolution was put and carried unanimously.

The Chairman: Well, ladies and gentlemen, that concludes the business of this meeting.

The proceedings closed with a vote of thanks to the Chairman which was carried with applause.

TWENTY-FIVE YEARS' SERVICE AT CHESTER.—Mr. J. R. Morris, Superintendent of the Chester Division of the Great Western Railway, has just completed 25 years of his service at Chester. Prior to his appointment as Assistant Superintendent in February, 1910, he had held responsible positions in the offices of the General Manager and Superintendent of the Line in London. It was in 1923 that he was appointed Divisional Superintendent. In commemoration of his silver jubilee of service at Chester, the District Goods Managers at Liverpool and Shrewsbury respectively, his Assistant Superintendent, chief clerk and heads of the various departments in his own office entertained him at a luncheon at the Grosvenor Hotel. Mr. R. E. Lampitt, Assistant Superintendent, presided, and referred to the sterling qualities of Mr. J. R. Morris and the fine example and leadership shown to all those who came under his supervision, and the qualities he possessed in dealing with important matters which constantly arose in the railway service.

NEW FORM-RELIEVED CUTTERS. — A new and valuable application of the well-known range of Stag high speed steels manufactured by Edgar Allen & Co. Ltd. is to a range of form cutters and hobs shortly to be placed on the market. They are being given the name of Stag Sharpaform and a feature of the design is that, while the form remains constant, relief is achieved without causing the tools to rub or not cut freely if the duty or feed is at all heavy. Edgar Allen & Co. Ltd. has obtained the sole United Kingdom and British Empire rights for the patent. The hobs will be manufactured under licence by David Brown & Sons (Huddersfield) Ltd., and cutters other than hobs by Stalker Drill Works Limited.

LONDON MIDLAND & SCOTTISH RAILWAY COMPANY

Permanent economies in maintenance—Accelerations—Railway C.O.D. service—Air transport developments—Further research—Transport in Northern Ireland

The twelfth annual general meeting of the London Midland & Scottish Railway Company was held last Friday, March 1, at Friends House, Euston Road, London, N.W.1. There was a large attendance and each shareholder on entering was presented with a copy of the March issue of the *L.M.S. Magazine* and other literature. In the afternoon any stockholders interested were invited to attend an exhibition, in the General Meeting Room at Euston, of cinema films used by the company for making closer contact between the management and the large and widely scattered staff.

At the general meeting Sir Josiah Stamp, G.C.B., G.B.E. (Chairman of the company), presided.

The Secretary (Mr. O. Glynne Roberts) read the notice convening the meeting.

The Chairman, who was received with applause, said:—Ladies and gentlemen, you will, I know, share with the directors the sorrow they feel at the sudden death in January of Lord Knutsford, who had sat at the board at Euston for 55 years. He attended a meeting at Euston the day before his death, and his mind was alert as ever, and he was as physically fit as many men who were considerably his juniors. By his long association with the London & North Western Railway, his experience was of great value to the board, and by his death all ranks have lost a good friend.

The Year's Results

For the second year we have a moderate improvement in net revenue and so have restored part of the heavy decreases of the years 1930-1-2. In railway working there was an increase of £2,386,000, or 4·1 per cent., in gross receipts and an increase in the working expenditure of £1,339,000, or 2·8 per cent., making the net increase £1,047,000, or 10·5 per cent. I have been asked why there should have been any increase in expenditure, and the chief reason is that we ran some 10,000,000 additional engine miles in the year in order to provide better services and secure better receipts. In the December half-year in particular we ran many additional passenger trains of improved quality both as regards stock and speed which were experimental and might not have justified the additional outlay, but in fact did do so. I warned you in advance of this increase last year.

A one-year comparison does not give a true reflection of the position, and I would like to show you the contrast between 1934 and 1929, which we have come to regard as the nearest "normal" year. Between the five years our railway receipts fell by £12,600,000, or 17 per cent., and in the same period expenditure fell by £7,600,000, or 13 per cent. I need not remind you of the causes of the great reduction in receipts—matters beyond our control—but as regards expenditure, in part controllable, the reduction is mainly made up of: maintenance of works, £800,000, or 11 per cent.; maintenance of rolling stock, £2,100,000, or 21 per cent.; operating, £4,300,000, or 13 per cent.

In maintenance of rolling stock the best results were achieved and represent the fruition, not yet complete, of the various steps I have explained at length in earlier years, steps which have more than maintained the quality and condition of your stock. In the same period there was a reduction of £3,000,000 in the capital expenditure on rolling stock and plant. We spent £15,600,000, of which £13,300,000 came from current revenue, and the balance reduced our rolling stock reserve funds. This was a conversion of your liquid resources into net revenue earning assets very fully justified by results.

Operating expenses in a large degree do not fluctuate with the traffic; an extreme illustration being a signal-box which is not appreciably affected if the receipts from trains passing it are reduced by 17 per cent. The reduction of 13 per cent. is, therefore, a good one. It is, of course, accounted for in part by lower wages rates and in part by the reduction in expenditure due to reduced traffic, but economies of a permanent nature also played a large part in securing it.

Maintenance of track and premises is an expenditure largely independent of receipts earned, and here we have had not only permanent economies, but for some classes of work an avoidance of expenditure not essential for safety purposes. I have received complaints that we have let decorative work get shabby at various places, and I agree that we have done so, although not where that would cause a greater ultimate outlay. We have properly given priority to, and fully met, claims for expenditure required for efficiency purposes, and the cutting out of frills which though desirable in the long run do not immediately affect net revenue is a necessity in hard times.

Ancillary Businesses

In the five years our ancillary businesses as a whole have shown a reduction in receipts of £900,000, but a reduction in expenditure of £1,300,000. The steamboat services in particular, with a reduction in receipts of £290,000, show a reduction in expenditure of £310,000 and yielded in 1934 the best net results in any year on record.

Road transport, canals, docks and collection and delivery all show net improvements in the five years. Hotels and catering show a net decline of nearly £120,000, a reflection of the reduced spending power of the community. There was a heavy fall in the net receipts from £480,000 in 1929 to £279,000 in 1932, but 1933 improved to £287,000 and 1934 to £363,000, a welcome indication of the partial recovery in passenger travel. Our catering services are not only directly remunerative, but have a competitive value in attracting business and indirectly contribute substantially to the results as a whole by the amenities provided for passengers, and last year we served 3,741,254 meals on trains alone.

In the other items the only changes of importance in the five years are the introduction of a new revenue of £250,000 in dividends from investments in road undertakings and a decline of £700,000 in other interest items, the latter due to capital outlay and reduction of renewal funds reducing the amounts earning interest and to the lower yield of high-class securities.

Five-Year Review

The five years' review for all activities of the company may be summarised thus:—

—	1929	1934	Decrease	Per cent.
	£	£	£	
Revenue	83,000,000	68,800,000	14,200,000	17
Expenditure ...	65,890,000	56,900,000	8,900,000	14
Net revenue ...	17,200,000	11,900,000	5,300,000	31
Debenture interest ...	4,400,000	4,400,000	—	—
Available for share capital	12,800,000	7,500,000	5,300,000	41

The moderate improvement in the amount available for the share capital from £5,500,000 at the lowest level of 1932 to £7,500,000 in 1934 still leaves that capital most inadequately remunerated, and the ordinary stock portion of it has borne the brunt in getting no return for three years and only a token return in 1931.

Only by a growth in gross revenue can a striking improvement be obtained and a sudden rebound to even the 1929 level of revenue is improbable. We hope for a steady

growth in the national prosperity which will gradually achieve that level, and are confident that the numerous steps taken to obtain permanent economies, coupled with the great programmes of re-equipment which have been undertaken, will result in a greater proportion of the additional gross revenue accruing to the shareholders. There are many cross currents, such as price levels and finer margins of profits due to the still very disastrous effects of the preferential treatment of traffic using the public roads, but we are clearly on the upward curve again.

This connection between the total national and our own revenues is of the greatest importance, for it is not direct nor exact. It is interesting to see from the graph that L.M.S. tonnages have the same trend tendencies as that of national production, in spite of increased road competition by goods motor-vehicles continually going up. The varying gap between the levels of L.M.S. tonnages and national production is due, of course, to the variations in production of articles which have a smaller effect on railway carryings than other classes of articles have. The extent to which railways can actually, apart from road competition, expect to share the changes in total national activity is a complex study. For example, in the first quarter of 1934 the rise in production got strikingly away from railway tonnage. But I have taken out the commodities for which we have separate railway tonnage and picked these out also from the production index, and the comparison in the rise is found to be very much closer.

Comparison with 1929

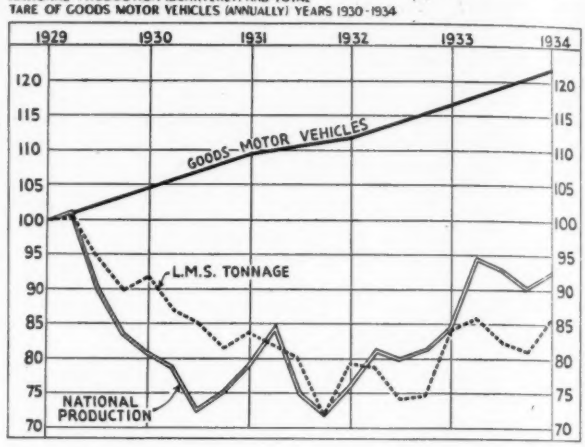
Looking, as we so usually do, at the comparison with 1929, one of the most important factors keeping the lines apart seems to be the fall in our overseas trade. On the one hand, productive industry has lost business only in respect of exports; from the fall in imports of manufactured goods it may have gained slightly. On the other hand, distributive industry has lost business in respect of both exports and imports. In other words, owing to the excessive decline in overseas trade, the total volume of trade in the country has fallen to a greater extent than production itself, and as the railway depends directly upon the volume of trade rather than upon national production, it is reasonable to suppose that since 1929 the relative level of railway traffic tonnages has fallen below that of industrial output.

Additions to or reductions of accumulated stocks of commodities would tend to enhance or offset this factor. Apart from traffic arising from possible reductions of accumulated stocks, the railways convey goods such as scrap iron, livestock, and timber that may not be necessarily regarded as current output. For these reasons a comparison of the two series is not strictly logical, but the attempt to make it in detail is most important and useful, because, while although some shareholders who write to me do not seem to realise it the railways cannot be more prosperous than trade will let them be, we certainly wish to see whether we are holding our proportion of all those changes in which, by the nature of the case, it is actually possible for us to share, or whether road transport is getting a larger proportion of any increase, and whether our cash receipts for what we do carry are depressed still further by their competitive traffics. This is a world problem, and I have read speeches by American railway presidents which, with a few changes in words and figures, would almost meet our own case.

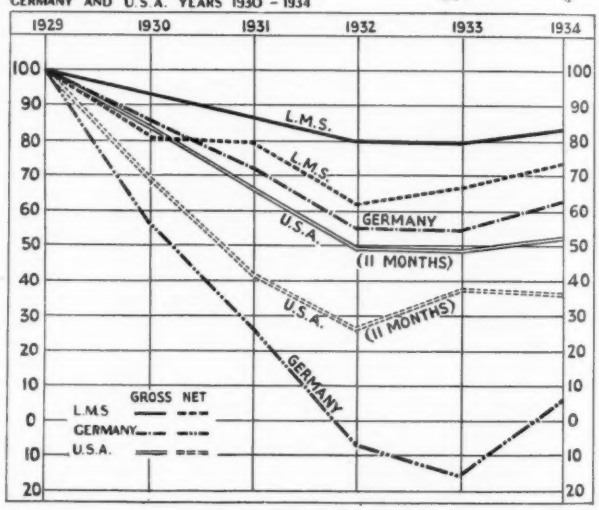
L.M.S. and Foreign Railways

The graph showing the gross and net receipts of our company alongside those of the German and U.S.A. railways is particularly interesting this year, inasmuch as the power (so fully exercised by our foreign friends) to dispense more freely with labour has now come to an end, due partly to national considerations regarding the absorption or prevention of unemployment. The L.M.S. trends, which depict a higher upward tendency in net receipts as compared with gross receipts, are more satisfactory, although I should like to see the gross receipts line tending more definitely upwards, so as to give more opportunity to show our power to improve net receipts when business is rising substantially, through permanent economies in expenditure. You will observe that our American friends have not been able to maintain their previous economy in expenditure, largely owing to political reasons; and during 1934 their net receipts position has declined, although the gross has improved. In the case of the German railways, the decided improvement in gross

L.M.S. TONNAGES (QUARTERLY) COMPARED WITH NATIONAL PRODUCTION (QUARTERLY) AND TOTAL TARE OF GOODS MOTOR VEHICLES (ANNUALLY) YEARS 1930-1934 — STANDARDISED ON 1929



GROSS AND NET RAILWAY RECEIPTS L.M.S. COMPARED WITH RAILWAYS OF GERMANY AND U.S.A. YEARS 1930 - 1934 — STANDARDISED ON 1929



receipts during 1934 has had the effect of turning a net deficit into a slight net receipt, but the staff has increased during the year by over 6 per cent.

Railway Rating

I have been asked to explain fully the position of the company in regard to its liability for local rates. As stated in the directors' report for 1931, under the Railways (Valuation for Rating) Act of 1930 the company's property in England and Wales falls to be revalued as from April 1, 1931, and the valuation, when finally determined, will, with minor exceptions, be in force until March, 1936, and so settle the payment for rates to the local authorities and to the railway freight rebates fund for that period of five years. Pending final determination the payments made and the charges in the accounts since April 1, 1931, are based on the existing valuation, and in their 1931 report your board stated that they anticipated substantial reductions in expenditure would accrue from 1931 onwards when the new valuation under the Act is finally settled.

The Southern Railway proceedings in regard to their valuation have been reported in the Press. We are encouraged by the decision of the Railway and Canal Commission in the

Southern Railway case to hope that a substantial reduction of our present liability for rates will be realised. It is impossible at this stage to be more precise on the subject of our prospects and the effect upon our accounts, as the matter is still *sub judice.*

We have strengthened our representation in Scotland by the appointment of Sir Robert Greig on the Scottish Local Committee. He was Secretary of the Department of Agriculture in Scotland, and on his retirement last year the company were fortunate in obtaining the benefit of his wide knowledge of Scottish affairs. Mr. Ernest Wharton has retired from the position of mineral manager and the functions of his department have been combined with those of the chief commercial manager. Mr. Charles Edward Fairburn has been appointed electrical engineer on the retirement of Colonel Cortez Leigh.

I explained last year that the new summer tickets, which have brought us many new travellers and extended the travelling range of old ones, were being continued throughout 1934. This longer period experiment justified itself, and not only has the steady decline in passenger receipts been arrested, but there is an actual increase of £429,000, and to that result the summer tickets contributed substantially. In common with the other companies we have accordingly made these tickets a permanent feature all the year round, under the new name of "Monthly Tickets." At the same time alterations in their availability have been made and first-class fares for these tickets have been reduced to 1½d. per mile. The passenger receipts were also aided appreciably by a careful research into local potentialities for day, half-day and evening excursions, and the development of "off-peak" periods.

Operating Improvements Continued

On the operating side, the various improved methods of working which I have described in previous years have continued to be progressively productive, despite some disturbance at holiday times, due to abnormal concentration of passengers on particular days and trains, following upon the recent freedom of large numbers of passengers from train restrictions, and I need merely mention a few new features. Assisted by the greater volume of freight traffic, the wagon loads, train loads, and terminal handling work all improved, and with marked increases in the number of parcels and tonnage of goods, the cartage costs per unit were further reduced.

The average mileage obtained from the locomotives in use, a most important figure owing to its reflection of the interest and maintenance cost of providing locomotives, has shown a progressive increase in each recent year, amounting in the last five years to 16 per cent. The 1934 figure of 110½ miles per locomotive per day is a marked achievement, made possible only by the combination of design, maintenance efficiency, shed working, and locomotive diagramming. It is one thing to improve the mobile unit of stock as it is renewed, but it is quite another to alter the almost fixed layout of the railway organisation suited to its original needs and evolved in the last 100 years.

The most recent contribution to operating economy is, therefore, in one of the heaviest costs of the railway, for it is no less than a comprehensive programme of running shed re-arrangements, including mechanisation of coaling and ash-disposal plants and improved layout of the shed yards, and concentration on a main shed in each area of the examination and running repair work of all the locomotives allotted to it, utilising the secondary sheds in the area for what can best be described as garage purposes only. This has permitted a roster of the concentrated examination and repair staff at the main shed in each area and their allocation to specific work for the whole, on the lines earlier adopted in the workshops, and has had a marked effect on the continuity of the work, and thus on the waste time of the stock.

Handling of Goods

Similarly, the arrangements for handling goods at terminal points have been the subject of various radical experiments which we are confident will effect steady reductions in our operating costs and handling times, in addition to those already effected. This is an important link in the throughout service and the dual object of quick transit from sender to receiver and the reduction of costs is being achieved. Ignoring traffic held at terminals to meet consignees' wishes, practically 100 per cent. deliveries on the day of arrival were effected in 1934. We are fortunate in having to supervise and inspire these fundamental changes of method, our Vice-President, Mr. E. J. H. Lemon, who did such pioneer work some years ago in the successful rationalisation of our carriage and wagon workshops, and now devotes his experience and engineering outlook to operating problems, with their important commercial consequences.

Acceleration Policy

The acceleration policy is perhaps most easily appreciated by examining the reductions in train times in the past couple of years. These aggregate in the case of passenger trains 21,000 minutes per day, and for goods trains 16,000 minutes per day. Passenger trains are most in the public view and our Royal Scot, with its all-the-year-round non-stop run of 299 miles, retains its favour with the public, sometimes to the embarrassment of our staff in providing several trains instead of one, but all last summer we had 52 further daily trains with non-stop runs of over 100 miles, including 14 with over 200 miles. The freight trains are not so well known perhaps; we have 18 express freight trains daily covering 4,340 miles, the longest run being the morning train from Aberdeen to London, a distance of 545 miles, with an average running speed of 43 miles per hour. Our new signalling arrangements have played their part in the general speeding up, and, in addition, the outlay has in itself been fully remunerative after meeting the necessary interest and maintenance costs, as 81 schemes completed in 1934 have earned over 20 per cent. on the outlay.

Generally, I should point out, these various improvements have been rendered possible by the large outlay we have incurred on new equipment, and you have every reason to be proud, not only of the physical condition of your rolling stock, but also of the economy of the large outlay which provided it; all subject to the closest scrutiny before approval by your board.

We have continued, and are continuing further, our own experiments with possible light passenger units propelled by their own motive power, and have also kept in close touch with like work elsewhere. With our particular flow of traffic and dense line occupation, our problems cannot be met by a mere repetition of methods adopted elsewhere, and so far there is no justification for any general departure from our present methods, but I am hopeful that some wider-scale experiments for special services will be productive.

Maintenance Costs

The careful control of maintenance costs and efficiency exercised for railway rolling stock extends to our 2,500 road motor vehicles. Our problem differs from that of the ordinary road haulier, because by far the greater part of our road haulage is for short distances to and from the railway stations. This restricts the average mileage obtainable per motor vehicle to a little under 9,000 per annum, but the maximum use of the vehicles has been increased to 94 per cent. of possible days of service. The relatively low mileage obtainable is one of the reasons why we still have a considerable number of horse-drawn vehicles, and the comparative cost of the alternative means of haulage is necessarily the test for each service. Where, with extended delivery areas, the motor vehicle is the more economical one a change-over is effected, and during 1934, 411 further motor vehicles were brought into use. These motors are largely of the type known as the mechanical horse, a tractor which originated from some investigations made by us in 1930.

As recently as July, 1934, the railway companies established a Cash on Delivery system under which customers may place orders without sending cash in advance, and vendors are assured of cash collection upon delivery of the goods. The arrangement, which has been extensively advertised, applies to all consignments not exceeding £40 in value, with certain exceptions, such as wet fish, livestock, &c.

XUM

The commission fee charged for performing the service varies from 6d. to 2s., according to the value of the consignment. Traffic under this arrangement, bearing a special "C.O.D." address label, may be collected from senders or handed in at railway stations, town offices or auxiliary offices for forwarding by either goods or passenger train service. The facility applies between all railway stations in England, Scotland, Wales, the Channel Islands, also to and from certain Continental ports. There is every indication that traders are realising that the railway C.O.D. scheme can be of real assistance to them on the transport side of their business, and the volume of transactions under this scheme is steadily increasing. We are grateful to Councillor Wilson, of Accrington, for the interest he has taken in this subject.

No change in the fiscal policies of the British and Irish Free State Governments took place during 1934, and trade continued to be hampered by the restrictions of the tariffs and quotas with their reaction on our revenue. The decrease in our carryings of coal amounted to roughly 300,000 tons over a period of two years. I welcome the recent official announcement of a trading agreement between the two Governments, under which the Free State will import about 1,250,000 tons of British coal in exchange for an equivalent value of Irish cattle. The exact effect cannot yet be seen; but some recovery in our gross receipts should certainly result.

Locomotive Policy

Our locomotive policy has been governed by two main considerations:—

(i) Reliability, in order to obtain by more intensive user a greater daily revenue-earning mileage.

(ii) The development of a locomotive which shall be equally efficient for handling certain express passenger trains and express freight trains.

During the past year two engines of the "Princess Royal" class have hauled the Royal Scot train between London and Glasgow, the engines working through in each direction, and a further 10 engines of this class will be constructed in the company's workshops during the present year. It is the intention to employ these engines with our most important long-distance heavy express passenger trains between London and Scotland and other points. Considerable progress has been made in the introduction of the new type of mixed traffic engine, which has been specially designed to work express passenger and express freight services, and up to the end of this year the number of this type will have been increased to 225.

Standardisation of locomotives and the provision of engines which have enabled the operating department to take full advantage of modern developments have reduced the number of locomotives since amalgamation from 10,316 to under 8,000 by the end of the present year, a reduction of over 22 per cent. This policy in turn has led to a reduction in the number of types of locomotives from 393 to 206. The reduction in total numbers without a corresponding reduction of the locomotives available for traffic has been, of course, largely contributed to by the much greater rapidity with which heavy repairs to locomotives are executed in the shops, details of which I have given in previous years. Another important point which needs stressing is that as a result of this standardisation with improvements in workshop and shed practices, the mileage between general repairs has been increased by over 90 per cent.

Diesel Engines

Last year I mentioned that we had ordered a number of heavy oil shunting engines of various types in order to test their utility and economy, and seven were delivered during 1934. In order to gain experience of greatest efficiency under service conditions, the locomotives purchased were of several types, the horsepower ranging from 150 to 400. The tests made indicate that the development of the diesel locomotive with electric transmission has sufficiently advanced to justify us acquiring more units of this type, and an order has recently been placed for 20 350-h.p. diesel electric 0-6-0 shunting locomotives, which has been divided between two prominent British engineering firms of whose units we have already had practical experience.

Continued progress was made during 1934 in the replacement of compartment types of carriages by modern vestibule and corridor vehicles to meet the changing public requirements. During the year 180 vestibule, 537 corridor, and 132 non-corridor coaches were built, the latter vehicles being required for suburban services. In designing the interior layout careful attention has been paid to comfort, and we have provided arm rests and shoulder lighting in our new third class corridor vehicles for long-distance travel. In addition, the design of the seats in corridor stock has been modified to give additional comfort, and an improved and more convenient system of ventilation has been afforded by the introduction of sliding lights on the body side. Due largely to improved methods of construction and the concentration of manufacture, these additional amenities now provided have not resulted in increased cost of construction.

Experiments in the arrangement of fittings and furnishings in first class sleeping cars to improve comfort and appearance will result in the whole of our fleet of first class and composite sleeping cars being modernised during the years 1935-1937. The berth compartments of 64 first class and 12 composite cars will be redesigned and 26 new first class and 13 new composite cars will be built in replacement of the older vehicles. All this stock will be provided with air-conditioning plant. While most of our important trains include kitchen cars which provide meals served in vestibule cars, on certain trains combined kitchen and restaurant cars are required, and in 1934 14 new cars were brought into service.

The improvement in the hotels and catering business is due to better trade and also the continued policy of systematic modernisation of the hotels. Our hotel at Kyle of Lochalsh has been modernised and the old wooden annexe replaced by a wing to the hotel, thus providing additional accommodation essential to the requirements of the tourist traffic to and from the Island of Skye.

Hotel Improvements

We have had under consideration for some time past the Queen's Hotel at Leeds, built over 70 years ago, the fabric of which would normally have required a large expenditure immediately. Modernisation was impracticable, and we were faced with either closing the hotel or rebuilding. Apart from our responsibilities to the travelling public there is a good catering business to be done in this great industrial centre, and it has been decided to demolish completely the present building and erect in its place a new one fully adapted to local requirements. This involves destroying some station buildings and providing new accommodation, and affords an opportunity of providing improved amenities at the station for the convenience of the public, and the better and more economical working of the station generally. The rebuilding will be put in hand shortly, and while it is in progress a limited amount of accommodation in the existing building will be preserved, care being taken to ensure that visitors using the hotel will not suffer inconvenience.

The decision to close the Midland Grand Hotel, St. Pancras, was reluctantly taken, but was inevitable having regard to the uneconomical results and to the fact that the building, although by no means ancient, was not capable of modernisation. To make provision for those who would otherwise be using the Midland Grand, certain alterations are being made to our Euston Hotel, and the existing refreshment room and dining room accommodation at St. Pancras will be improved. It is intended to utilise the hotel building for further office purposes of the company.

Shipping Services and New Vessels

Our steamboat services as a whole have, as I mentioned earlier, shown the best results of any year. The Heysham and Belfast service, the principal connecting link between England and Northern Ireland, largely contributed to them, and the results have more than fulfilled our anticipations when we concentrated on this route a few years ago. This has not had any detrimental effect on the Stranraer and Larne short-sea route, which meets a separate class of public

requirement and continues to gain in favour. The services between Holyhead and Kingstown and Dublin have been adversely affected by the trade restrictions, which have also had a very serious effect on our Continental services from Goole.

The five vessels which I told you were under construction this time last year, including the *Princess Maud* on the Larne and Stranraer service and the two paddle steamers on the Clyde, have all been placed into commission and have proved successful. We have three vessels now under construction. The increased popularity of the Heysham and Belfast service has necessitated a new steamer, to be launched next week, and we are continuing our policy of installing mechanical stokers, which have proved economical, and automatic sprinklers for the safeguarding of the vessel against fire. A new livestock and cargo steamer is also nearly ready for use on the Holyhead and Dublin service, and it will embody all the latest designs of her class and will replace two of the older steamers which have completed their useful lives, and, in addition, a new paddle steamer for the Clyde and Scottish lochs services has just been launched.

Electrification Prospects

I must again refer to electric traction in so far as it affects us. We have 117 miles of road, or 282 miles of track, which has been constructed or adapted to electric traction during the past 32 years, at a cost, with equipment, of £11,000,000. Close consideration has recently been given to further suburban electrification and the general question of main line electrification. Although our inquiries are not complete, there does not appear to be any likelihood of any further large-scale outlay in the immediate future. We have a statutory obligation to show annually to the Railway Rates Tribunal that our affairs have been conducted with efficiency and economy, quite apart from the board's obligation to you in this respect, and any new outlay for electrification or anything else must comply with that test. If any new work is unlikely in due course to pay its way, clearly the burden will fall on railway users generally, or the proprietors or employees, or partly one or another. Such outlay differs from the competitive expenditure on public roads for motor traction, which causes a charge on the rates, whether the expenditure is commercially justified or not. Those who talk glibly on the subject without knowledge of the facts may not bother much about this aspect, but we have to do so. The merits and amenities of electricity have to be weighed against the merits of other forms of tractive power, with due regard to the risk involved in new outlay on fixed plant in the present still indefinite position of the finance of the public roads.

Economies in Stores

I have mentioned previously the substantial reductions in stocks of stores and materials, which this year show an upward trend on account only of the larger stocks purchased for new constructive work. The extent and variety of the stocks are amazing. The items vary from a gum brush to a complete boiler for the Royal Scot, and the total number of different commodities stocked, each bearing a separate catalogue reference, roughly corresponds with the number of shareholders in the company. Through improved storekeeping arrangements, and the gradual fruition of reorganisation, the additional accommodation at Euston House has made it possible to effect further centralisation with direct saving in clerical staff.

A central orders office has now been operating for a little over two years. Its functions include the compilation of estimates of materials required for each ensuing year and the issue of all orders for supplies from contractors, and also in the near future the completion of the placing of all orders in the company's workshops required south of Carlisle. We are now able, for example, to the fullest extent—

(*a*) To reduce the total stock by rendering it more fluid, and enabling quick transfers to be made.

(*b*) To co-ordinate the bulking of the small purchases formerly made by the local resident storekeepers, thus saving about £7,500 per annum.

(*c*) To regulate the supplies of materials to the various stores or points of consumption to accord with the actual dates they are required for use, and the payment therefor according to the specified delivery date, with a saving of at least £5,000 per annum in interest alone.

Many other advantages have been derived from the establishment of this office rendered possible by the concentration of stores staff at Euston House.

Transport in Ulster

In reply to a question which Sir Charles Stuart-Williams put to me last year on behalf of the British Railway Stockholders' Union, I explained the difficulties of our Northern Ireland undertaking, and informed him that with the other railways, we had made representations to the Government to secure equality of treatment between rail and road. Shortly after that the Northern Ireland Government appointed Sir Felix Pole to examine the question. His report in July recommended that all passenger and goods road motor services in Northern Ireland, including railway road services, be taken over by a new Statutory Board and that the railway companies and that board should pool their traffic receipts. Generally, the pooling scheme he proposed follows the lines of the London Passenger Transport Act, including a Standing Joint Committee composed of an equal number of representatives of railway and road interests, but in Northern Ireland the pool will cover all classes of traffic and not merely passengers.

A transport tribunal was also recommended to deal with appeals by the public, or by railway or road interests, regarding fares, rates, services, &c., and replace the Railway and Canal Commission and the Road Transport Fares Tribunal. Subject to this right of appeal the scheme provided that the existing regulations of railway rates and charges should be repealed, thus placing rail and road traffic on equal terms in this respect. Sir Felix Pole also recommended that the railway companies be relieved from the obligation to maintain the surface of public roads on bridges and their approaches, and that the railways should be free to deal with the relief of local rates by de-rating in the same manner as other industries. The Northern Ireland Government have decided to adopt these main principles and it is understood that a Bill will shortly be introduced.

Irish Free State Transport

As you are aware, we are also interested in the Irish Free State, and it is interesting to note the different methods the two Governments have adopted, or are proposing to adopt, to deal with this difficult problem, and to compare them with the position in Great Britain. In the Irish Free State transport services, both passenger and goods and both rail and road, are concentrated largely in the hands of the railway companies, the road side of their undertakings coming under rate charging regulations of similar nature to those applying to the railway side. In Northern Ireland it is proposed to concentrate road services largely under a public board with a pooling arrangement with the railways, and again with equality of treatment of both forms of transport in regard to regulation of its charges.

But in Great Britain, on the other hand, there has so far been no comprehensive scheme. The railway companies' net revenues are regulated by Parliament, and the charges aimed at securing such net revenues are on a comprehensive plan, applying to all grades of traffic, whether passenger, goods, or mineral. On the road side, independent machinery settles the charges of omnibuses and coaches by means of conditions attached to their monopoly licences, and, on the goods side, the licensing system now in force will certainly make it possible for the authority to have regard to the rates charged by the licensee, but there is no positive statutory arrangement like that applicable to railway charges, or anything approaching a comprehensive classification of charges.

The experience of the working of these three distinct attempts of the Governments concerned to deal with the present difficulties will be watched closely, and we are also keeping in touch with the treatment of similar problems all over the world. While generally the fixation of rates and charges is the crux, there is the over-riding difficulty that the railways usually cater for all classes of traffic, and road hauliers for certain selected traffics or for certain areas only,

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and a comprehensive and balanced scale of charges applicable to all classes of traffic may still be nullified by the concentration of a particular road haulier on one particular class of traffic or on particular areas only.

The London Transport Pool

The partnership arrangement established on July 1, 1933, in regard to London passenger transport by rail and road, is functioning smoothly, and a detailed examination of the relative financial data has now been made to establish the pooling proportions of the Transport Board on the one hand and of each of the four main line railways on the other hand. As a result, a draft pooling scheme was submitted at the end of November last for confirmation by the Arbitration Tribunal; when it is approved the pooling proportions of the various parties will have been duly established. Although we have only a relatively small partnership interest in the pool, there can be no doubt that the scheme will prove distinctly advantageous to us, seeing that wasteful competition is eliminated, both as regards day-to-day traffic, and also as affecting any new development works which may be undertaken for the benefit of the London area passenger traffic.

Last year I expressed the opinion that it was desirable for the four main line companies to act in co-operation in air transport, especially in view of their overlapping interests. The negotiations in progress last year with Imperial Airways Limited for the formation of a separate company, jointly owned with them, to provide such air services as any of the railway companies might desire, led to a new company being set up under the title of "Railway Air Services Limited," with a nominal capital of £50,000. Its purpose is to provide such internal air services as may be required by any of the four railway companies.

During 1934 a number of air services were provided, the principal being probably the daily service between London, Belfast, and Glasgow, commenced in August last, at our instance. Any service of this kind is, of course, in its early stages, more or less experimental, and on a route of this character, embracing sea passages in the northern part of these islands, experience has had to be acquired under varied weather conditions. This experience we now possess, and over the period of approximately six months a regularity of 91 per cent. has been attained. The main section of this route is being operated with air-liners which are substantial in size and construction and have high cruising speeds, the aim being to provide nothing less than the best available in air transport at this present stage of progress for those who, for reasons of greater expedition or otherwise, desire to make use of air transport for themselves or for light goods.

The extent to which air transport will develop in this country in view of the comparatively short distances involved and the high quality of the surface communications remains to be seen. If air travel is conducted with due regard to those standards of operation with which operators of standing and responsibility naturally identify themselves, its cost is somewhat higher than the cost of first-class railway travel, and it would seem for the present must so remain. As air transport develops, however, costs may go down, and at some stage actual profitability should be reached. We are, in the meantime, admittedly at some cost to ourselves, ensuring for the L.M.S. Company in the internal air transport of this country a place appropriate to its importance and interests as a carrier by surface transport by land and water. With regard to the future, all I can say is that we are carefully weighing all possibilities and shall vary our services as circumstances and experience dictate.

There have been two flights on which exceptional timings were recorded, namely:—

Friday, February 1. *Mercury*, piloted by Captain Oliver—

Belfast ...	... dep.	9 35	} 151 m.p.h.	
Liverpool ...	... arr.	10 40		
Liverpool ...	... dep.	11 0	} 169 m.p.h.	
Croydon ...	... arr.	12 4		

The overall speed was 160 m.p.h.

Thursday, February 14. *Jupiter*, piloted by Captain Poole—

Belfast ...	... dep.	9 40	} 172 m.p.h.	
Liverpool ...	... arr.	10 37		
Liverpool ...	... dep.	10 57	} 166 m.p.h.	
Croydon ...	... arr.	12 2		

The overall speed in this case was 169 m.p.h.

I must refer again to scientific research and the increasing value to the departments of a special research organisation to which they may refer their problems and difficulties. The fact that the research staff has had to be appreciably strengthened to deal with the volume of work submitted is conclusive evidence of the wisdom of setting up an independent unit. Its fundamental object is to assist in raising our net revenue, and this aim can be attained either by improvements in methods of maintenance and operation leading to direct savings, or by assisting in the development of better facilities or amenities. An interesting example of the former is a better method for manufacturing train-lighting cells at Wolverton. The assistance afforded in various problems connected with refrigerated transport has opened up the field in several new directions in which the transport of perishable goods is involved, while investigations into the heating and ventilation in carriages enable the effect of various improvements to be determined with a certainty that was lacking in the past.

The successful operation of the complex heating and ventilating installation at Euston House has been brought about with the least possible delay, largely through the fact that the research staff were available to make accurate measurements of the physical conditions inside the building and indicate just where better control was needed.

Research

Research is not confined to the technical and engineering departments. The methods of scientific research are permeating all departments, and special development sections in the commercial and operating departments are doing important work. For example, the principles of refrigeration only found their appropriate commercial applications to particular services by detailed research of a scientific character.

I referred last year to the new building in Seymour Street, Euston House, then just completed. These modern offices accommodate the headquarters establishments of the commercial, operating, signal and telegraph, and stores purchase departments, and about 1,350 persons are housed therein. I outlined the advantages of this concentration of "public contact" departments easily accessible to the trading and travelling community, and close to the executive. They have been fully realised, and substantial economies in clerical costs and other directions have also been effected. Approximately half the outlay on the offices was recognised by the Government as fulfilling part of our obligations under the scheme for the remission of passenger duty. These obligations have now been fully discharged.

Railway Wages

In January, 1931, owing to the serious fall in revenue, the companies made application to the National Wages Board for a reduction in the salaries and wages of their employees. As a result the salaries and wages of all ranks of the service have been subject to percentage deductions since March, 1931. These deductions, subject to certain minima and modifications so far as workshop employees were concerned, were 2½ per cent. on all earnings, with a further 2½ per cent. on all earnings in excess of 40s. per week. In addition, certain relief was obtained by the companies in the basis of payment for Sunday duty, overtime, and night work.

Early last year the trade unions applied to the companies for a discontinuance of the percentage deductions, pointing out that our receipts were showing an upward tendency, and also that the workers in certain other industries and in Government and local authority employment had had wages cuts restored. After prolonged discussions, the railway companies and the unions agreed to a discontinuance of the second part of the percentage deductions, that is to say, the 2½ per cent. on earnings in excess of 40s. per week—1¼ per cent. to be restored as from October 1, 1934, and the remainder from January 1 last. The position now is that, subject to certain minima in the case of the lowest paid staff, a general deduction of 2½ per cent. is made from the earnings of staff in all ranks.

Your board, with a full knowledge of the conditions as they existed over our own system, and of the demands being

made upon our labour force now, and in the immediate future, were agreed that these concessions were in your best interests, and nothing has happened since to make them alter that opinion. The fact that the increases were given in anticipation of a maintenance of advancing revenues, which has not yet fully eventuated, in no way invalidates that decision as at that time, but it does clearly indicate that, until the progress of industrial recovery has resulted in a higher level of revenue being reached, any question of giving further improvement in wage conditions must be postponed.

I explained to you last year that, as a result of the position which had arisen in connection with the proceedings of the National Wages Board, the railway companies had given 12 months' notice, under the provisions of the Railways Act, 1921, to terminate reference of any questions concerning rates of pay, hours of labour, or other conditions of service to the Central Wages Board, or, on appeal, to the National Wages Board. That notice expired on March 3 last year. A special joint committee of representatives of all parties was, by agreement, appointed to suggest a more suitable form of negotiating machinery. You will have read in the Press that this special committee has unanimously agreed upon a scheme which they have recommended for approval and adoption, and I am pleased to say that the report has been approved by the unions and the companies, an agreement which brings this new scheme of negotiating machinery into force from to-day.

Road Problem

In dealing with the road problem last year I referred to the new legislation of 1933; to the higher licence duties imposed following the recommendations of the Salter Report; to the acquisition by the four main-line railway companies of Carter Paterson & Co. and Hay's Wharf Cartage Company —better known as Pickfords—and to some other allied questions. These are steadily working out a new position, but there are no outstanding developments to which I need specifically refer.

The Road and Rail Traffic Act, 1933, as regards protection of bridges over railway lines, has not yet been brought into operation by the Minister, but much information has been supplied to him, at an appreciable cost, about many existing bridges designed and constructed to standard which; of course, did not contemplate use by heavy motor vehicles and their axle weights. As you will have seen in the Press the Minister of Transport aims at eliminating within five years all existing bridges of importance which, by reason of their design, cannot with safety be used by modern heavy motor vehicles, and discussions are in progress with him and the highway authorities for a number of reconstructions to meet these new requirements.

The " Agreed Charges " arrangements—also a product of the Road and Rail Traffic Act—are proceeding satisfactorily, and you will be interested to know that in each case where an " Agreed Charge " has been made the Railway Rates Tribunal have approved it and each case has benefited railway net revenue.

Last year the direct dividend return from our own investments in road passenger undertakings was over 7½ per cent., the total earnings being substantially higher.

During 1934 £488,000 has been realised by sales of property surplus to the company's requirements in England and Scotland. This is a substantially higher figure than has been obtained in any previous year. £180,000 of the amount was realised by offering a number of lots at public auction sales held in London, Birmingham, Crewe, Sheffield, and Hull.

Educational Films

For some time I felt that with a large organisation like the L.M.S. it was necessary to adopt some means for making closer contact between the management and our large and widely scattered staff, and we decided to use films as an educational and unifying force for this purpose, and the following have been made:—" Ships of the Narrow Seas "; " Corridor Third "; " Passenger Trains of the L.M.S."; " Freight Trains "; " Euston House "; and " Events of the year 1934 "; while others are in course of preparation. The films were sent on tour to the various centres of the company's system, and the total attendances for the three months, October to December last, were 38,000. They have been the means of creating the utmost interest amongst the staff in various phases of railway work.

In another direction we are making and using films for demonstrating to the staff the latest methods of working. In a normal way any improved system of carrying out our operations must be in the nature of experiments at one or two places, but by means of films we are able to distribute and demonstrate quickly and accurately to all members of the staff what ideas we have in mind and prepare them for the changes and improvements which can be made, so securing their initiative and good will. Again, from the public point of view, films of the smaller size descriptive of scenic and tourist interest have been prepared and distributed to the chief commercial centres for public and private use.

The Outlook

If it is to be possible at all at the present moment to get any clear view of our prospects for the coming year, it can only be done by resolving the problem into its three essential questions: (1) What are the prospects of the trade of the country on which for the major part our prosperity depends? (2) What will be the influence of those prospects upon our gross traffic receipts, having regard to the geographical distribution of our system and to the nature of competition by road, water, and air? And (3) what are the prospects of material changes in the deductions from gross receipts before net revenue is determined?

On the first point it was clear at the turn of the year that there had been a distinct check in the process of recovery. Allowing for seasonal influences, the improvement in employment was not encouraging—January has done nothing to help that aspect. The distributive trades and many of the older minor trades are not forging ahead. Coal consumption is not advancing. On the other hand, exports in December and January showed a marked advance, and there is great activity in the constructional industries. But the international trading and monetary situation continues to be most discouraging, and leaves us dependent still upon domestic revival. As a result of all these factors, it seems that we may well hope to hold the present position and, indeed, make some fair advance upon it, but it is unlikely that there can be any spectacular leap forward in the near future.

Importance of Foreign Trade

On the second point, the railway share of the trade, you will have seen that geographically we are particularly sensitive to the fortunes of the industries which show less advance—namely, coal, shipbuilding, cotton, wool, &c.—and our railway serves all the depressed and semi-depressed areas except one. The graph for 1934, as I have explained, indicates that a revival of foreign trade is of great importance to us, and we must continue to look anxiously at the network of tariff restrictions and exchange difficulties which choke the normal flow of exports and imports, discourage tourist travel, and lead to embargoes on new foreign loans and moratoria on the service of old ones.

Economy and security of governmental finance, and a happier issue of the various new deals than at present seems likely, are necessary to stabilise commercial confidence, and without that confidence the available cheap money will not be actively utilised. These long-range world influences on Britain's industrial prosperity through foreign trade are of as vital interest to the L.M.S. Railway as any purely domestic recovery.

Competition for the available business of transport is still in an unstable condition. Although the effect of recent legislation will do much, when it is finally effective, to restore the balance of costs, there is still a very great deal of uneconomic road transport, which is only of short run benefit to the community and is a great immediate danger to us. A large number of new heavy oil vehicles are coming on the roads which are not bearing the true burden of contribution to their own road costs, and enjoy the power to pick and choose their traffics according to their profit and convenience. We must expect, therefore, to continue to suffer from this competition to an important extent.

In our traffic receipts we obtained, during the first half of

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1933, 78 per cent. of the corresponding period of 1929, and during the second half 80½ per cent. We started off 1934 at 84 per cent., but it finally worked out at 82½ per cent. for both half-years. We have again begun the year at 84 per cent. of 1929, so that you will see how hesitant is the character of the recovery.

In the third place, on the deduction from gross revenues, you are aware of the position in regard to wages and salaries, which will mean for 1935 a charge of £360,000 in excess of 1934, apart from any additional staff employed to deal with additional business. You know all there is to be said on the heavy burden of local rates and the prospects of respite. Whatever the changes in the volume of traffic, a very large part of the enormous economies of the past few years will be retained, and the pooling schemes and the many improvements in organisation and efficiency in every department will continue to be fruitful in further savings.

The spirit of the staff and their zeal for results which are in your interests has never been higher than to-day, and I should like to convey to them on your behalf thanks for the great efforts they have made during the many years of depression from which they are emerging at last. Each may work with even more spirit towards the quota that has been set him if he knows that every stockholder will also set himself and achieve his quota of increase in rail travel, recommendation, and public and political influence in all questions affecting the company's business.

Now, ladies and gentlemen, I beg to move that the report now read, with the statement of accounts, be received and adopted.

The Deputy Chairman (Mr. E. B. Fielden, M.P.) seconded.

Shareholders' Remarks

Councillor John Wilson thanked the Chairman for the reference to his work in connection with the establishment of the C.O.D. system on the railway, and hoped that the directors would consider the question of extending the present £40 limit of value per consignment. He also suggested raising the rates on some of the heavy traffics.

Mr. Johnston referred to the agreement with the trade unions on wage cuts, and asked whether the board had participated in the 2½ per cent. advance.

Mr. Macadam criticised the form of the abstracts in the accounts on the ground that they did not show clearly what was the actual cost in each department. The sum of £2,544,309 had been taken from revenue reserves, which would mean in the current year a loss of £90,000 in interest at 3 per cent. less earnings. In the hotels department the profit was £76,000 higher than in 1933, but it represented only 6.83 per cent. on capital outlay. The reason for the return not being greater was the high scale of hotel charges. When there was so much complaint about low salaries and low wages it was remarkable to find the deposits in the company's savings bank had increased by £1,120,611 over 1933. The amount of the superannuation fund was increasing at too great a rate, and he thought that in the Bill now before Parliament power should be taken to reduce the contributions both of the company and the staff.

Mr. Ashley Brown wished to affirm the principle of what he might call the most favoured nation treatment to stockholders, whose property the railways were.

Mr. Plant regretted that the details of capital expenditure for the year did not show any new enterprise of promise.

Mrs. C. M. C. Smith thought that a lady director might do much good with regard to catering in hotels, and so on, and the elimination of waste. She was also of opinion that suggestion boxes at stations for shareholders might do some good, and she urged all shareholders to join the stockholders' union.

Mr. Leslie Boyce, M.P., said he had good reason for believing that raising the rates on heavy traffic would decrease rather than increase revenue. In Lancashire and West Yorkshire the transference of coal traffic from rail to road and in other parts of the country was a very serious and growing menace. This was the largest corporation in the world, and the directors were discharging their task in a remarkably exemplary manner. The goodwill of the employees throughout the system was a vitally important asset in the fight the company was putting up for traffic. The directors and management, in making the agreement with the railway unions as to the partial restoration of wage deductions, had done what in the circumstances was the right and best thing for the company and for the railway industry.

Commander Inglefield called attention to the large amount of £191,000 paid in claims for loss and damage to goods in transit. He would like to see the dining car accounts separated from those of the hotels so as to show the hotel results more accurately. As the hotel at Leeds was being reconstructed perhaps something might be done about making a joint station there with the London & North Eastern.

Mr. Green asked whether it would be possible to take advantage of the cheap money now existing and convert some of the prior charges into a lower interest-bearing stock.

Mr. Watkin suggested an extension of the arrangements now prevailing with the Cyclists' Touring Club regarding the carriage of cyclists out into the country and more advertising for facilities for cyclists.

Chairman's Reply

The Chairman: I will deal as well as I can, briefly, with the numerous interesting points which have been raised. Starting with the first speaker, Councillor Wilson, he refers to the introduction of the C.O.D. system. That is not, of course, a matter dependent entirely upon the London Midland & Scottish, but has to be agreed with the other companies as a Clearing House question, and some limit, at any rate for a beginning, has to be put; but Councillor Wilson has already been assured that an extension of that limit will have, and is having, the careful attention of the railways jointly in the Clearing House. It may be that his ambition to have a rather higher limit may be achieved when we have worked successfully at the lower one. He may be quite sure that we shall not lose sight of it, and I hope it may be found practicable to do as he wishes.

With regard to the suggestion that the rates on the heavier classes of traffic should be raised in order to get a dividend, that is the very class that is put before the companies, and the Railway Rates Tribunal, every year, and the case has to be made for keeping the rates where they are, for lowering them or raising them according to what is best for the revenue, and the Railway Rates Tribunal have to decide with us whether a given action in either raising the rates or lowering them would increase net revenue, and if they have come to the conclusion, after very careful examination of all the facts, that no such change would benefit the railway revenues, then I am sure Councillor Wilson would acknowledge that they have a very good chance of being right in their examination of the facts.

A great deal has been said about the increases in wages, and I was very explicit in my speech to tell you that your board, considering the circumstances as they existed on our line, were clearly of opinion that it was the proper action to take and they still remain of that opinion, and they do know a very great deal that it is not open to you to know. For instance, we know how important is the goodwill of the men in the numerous changes that we are asking them to make in the habits of life. We are asking them to do things differently from the way in which they have done them before. We are very thankful to them for having done things without making a fuss. Their goodwill towards us is a very valuable thing, and that is a factor that influences us. We are quite aware of the important considerations you have raised about revenue. The board have participated in cuts; I think it was announced to you some years ago that they accepted a voluntary cut of 25 per cent., and that still remains.

Mr. Macadam gave us, as we are used to have from him, a long dissertation partly on accounts and partly on policy. He made various references to the subject of the accounts. Well, their form is settled by Parliament; the actual outlay is shown; transfers are shown for renewals which are charged evenly, but they are spread as necessary. Our method of doing a renewal account I should have thought by now would have been perfectly open and known to you.

With regard to the hotel question, the prices are not fixed just at random in particular places; they are fixed to

meet the best revenue earning power of that particular hotel, and at most of the hotels there are rooms which are highly priced and those which are much more modestly priced, and I do hope that when Mr. Macadam goes round again he will ask for the modest priced ones, too. At any rate, the charges are continually being varied in order to search out that elusive thing, the greatest net revenue, and therefore to be in your interests. We are very alive to the necessity for having a wide range of popular prices, and in many districts that policy has been followed with success; in others the attempt has not been so successful. If Mr. Macadam will go to Gleneagles at the expensive time he is asking for what he gets!

With regard to Savings Banks, they are open to 220,000 staff and dependents, and they show the same kind of movement of increase that all Savings Banks are showing throughout the country in large industrial undertakings. I think we are sharing in the general movement, and it is not one which I should deprecate. With regard to the question of superannuation funds, they are a statutory feature, a part of the conditions of service, as far as the past is concerned, and you know—it has already been referred to—that there is a Bill in Parliament for altering them on terms which will perhaps be more agreeable to the speaker—altering them as far as the new entrants are concerned.

One of the speakers referred to the fact that we never spend any money, that we had not been encouraged to spend any money on anything new. We usually get the other story: "Why have you been spending money on this, that and the other?" I think it is a little exercise in accountancy to see how we were reducing the capital account and at the same time, over a relatively short period, we have spent seven millions of money. An open meeting like this is not a suitable place for giving lessons in book-keeping, particularly the very complex accounts that the railways deal with. But we have spent in various directions large sums of money; a large sum of money is going to be spent at Leeds, as I explained, and, while on that point, may I say every advantage will be taken of this opportunity to make Leeds station a worthy one and also to introduce, with the assent of the London & North Eastern Railway, joint working at that place. That is a part of our plan.

Mr. Ashley Brown was desirous of emphasising the principle—he did not move an actual resolution—that the railway is the property of the stockholders. It certainly is in the sense of their holding the stock, but it is not in the sense that any stockholder is entitled to any use he can make of it differently from any ordinary person, because if that principle were introduced we should have an absolutely chaotic system. People with very small holdings living very long distances away might secure advantages that those of you who live in London would be quite envious of. I will only say this to Mr. Ashley Brown, that if he can carry out that principle in a concrete scheme which is workable over all the railways and does not give rise to abuse and difficulty among the shareholders, we shall be willing to consider it. Nobody has put forward a scheme so far. When we come to the question of facilities other than free travel, I should like to remind you that you can already get cheap tickets, under various conditions, for parties of eight and above that. We have an obligation as directors to apportion the reserves of the company as far as they are available among the shareholders, according to the shares held by them respectively. The only benefit a shareholder can derive by law from his holding in the company is a dividend on the stock that is in his name. If you start distributing other kinds of dividends not in proportion to the holdings of stock which would come about by any system I have seen so far we should certainly be extending considerably beyond our legal powers. I am perfectly willing to consider, and to have the other railways consider, because we should have to work jointly, any scheme worked out in detail which will avoid these difficulties.

I listened with interest to the lady who spoke. The question of a suggestion box is a very useful one, but it is much better to send the suggestion either through the stationmaster or direct to Euston, where it will receive very careful consideration. These boxes tend to accumulate more cigarette paper than they do suggestions.

I thank Mr. Leslie Boyce for his observations; he was quite right in what he said about the position of the heavy traffic. The whole of the de-rating system introduced by Mr. Winston Churchill was designed to make the traffics rise in those heavy industries by lesser rates, and while the legislation may not overcome the depression it has the effect required.

There was a question by Commander Inglefield about the claims. They are still a formidable thing. We have a special department which shows the greatest ingenuity in driving hard at those features, and we have been very successful. From 1923 down to 1934 we have reduced the claim bill by well over 20 per cent. It is being watched continually in all directions.

With regard to the dining-car question, the hotels are charged with the equipment of kitchen cars and various other standing charges of that sort, and I do not think that the result shown is an unfair representation of their results.

The resolution regarding the adoption of the report and accounts was put to the meeting and carried unanimously.

The Chairman then moved the declaration of the final dividends proposed—namely, £2 per cent. on the four per cent. guaranteed stock, £2 10s. per cent. upon the four per cent. preference stock, £3 2s. 6d. per cent. upon the five per cent. redeemable preference stock (1955), and a dividend for the year of £1 12s. 6d. per cent. upon the four per cent. preference stock (1923), all less income tax.

Mr. E. B. Fielden seconded the resolution, and it was approved.

On the motion of the Chairman, seconded by the Deputy Chairman, the retiring directors were re-elected.

On the motion of Councillor Wilson, seconded by Mr. Macadam, Mr. Frederic Ditchfield Morris was re-elected an auditor of the company.

Mr. Leslie Boyce proposed a vote of thanks to the Chairman, and also to the Directors and Management for their services during the past year, which was duly seconded and was carried with acclamation.

The proceedings were then brought to an end.

SPECIAL GENERAL MEETING

A special general meeting of the London Midland & Scottish Railway Company was held at Euston station on Tuesday, March 5, Sir Josiah C. Stamp, G.C.B., G.B.E. (Chairman of the company), presiding. The Secretary, Mr. O. Glynne Roberts, read the notice convening the meeting.

The Chairman: This meeting is held in accordance with the Standing Orders of Parliament to submit for your approval a Bill and Provisional Order.

The first is the London Midland & Scottish Railway Bill, which is promoted by the company and which provides for the acquisition of additional lands required for the purposes of your undertaking in the Counties of Essex, Chester, Gloucester, Hertford, Lancaster, Worcester, and Stafford. The additional lands in the County of Essex are required for developing the company's Tilbury line by the provision of increased facilities for dealing with goods and passenger traffic. The remainder consist of areas adjoining our railways at various points where further accommodation is or will be required. The Bill makes permanent provision for regulating the tolls and charges leviable by the company and the West London Extension Railway Company upon the canals in England belonging to them; it also authorises alterations in the scale of contributions as regards future members of the Superannuation Fund of the company.

The Provisional Order is promoted by the company for the purposes of extending the periods for the completion of railways and works, and the acquisition of lands in Scotland authorised by various Acts and Orders, and also contains provisions as to charging powers upon the company's canals in Scotland.

In reply to a question, the Chairman said that the main object of the superannuation proposals in the Bill was to increase the contributions of new entrants for the same benefits as were now being given. It was considered that the present contributions were not satisfactory, having regard to the benefits being given.

The Bill and Provisional Order were approved.

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Belfast & County Down Railway Company

The ordinary general meeting of the Belfast & County Down Railway Company was held at Queen's Quay station, Belfast, on Wednesday, February 27, Mr. Thomas Richardson (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts, said the gross receipts from all sources at £206,347, showed a small increase of £431 as compared with the previous year, while expenditure at £190,141 showed an increase of £254, the net income being only £177 in excess of that of 1933. After bringing in the balance of £1,050 from 1933 and deducting fixed charges and the interest on debenture stocks, as well as the dividend on the 4½ per cent. "A" preference stock for the second half of the year, there was left a balance of £1,692 to carry forward.

At the meeting of twelve months ago he expressed himself as being more optimistic than for some years previously as to the future of the railway, in view of the then improving conditions of trade and industry in Great Britain and Northern Ireland, and the brighter prospects of the shipbuilding yards and of the linen and other industries in Belfast. He was, however, keenly disappointed that the general improvement in trade, which had undoubtedly taken place in many industries, had by no means fulfilled his expectations, and had not effected nearly so much for the betterment of their railway as he had hoped for. It was true that there had been a marked increase in revenue from workmen's tickets, chiefly as a result of increased employment in the local shipyards, but under practically all headings of purely railway traffic their receipts had continued to decline, a feature which could only be attributed to two factors, viz., the ever-increasing and intensive road motor traffic, and unfavourable weather at the particular periods when they looked for a heavy excursion traffic to their seaside resorts, such as Bangor, Donaghadee and Newcastle.

The principal features in connection with last year's passenger traffic were a decrease of about 10 per cent. in receipts from first and second class passengers and a somewhat smaller revenue from first and second class subscribers, due in a large measure to the more general use of private motor cars. On the other hand, their third class traffic (exclusive of seasons and workmen) showed an increase of 76,000 in numbers, but a reduction of over £2,550 in receipts. Workmen's traffic showed an increase of over 95,000 or nearly 33 per cent. in numbers, and £1,900 in receipts, and third class subscribers increased by nearly 10 per cent. in numbers and £555 in cash. Passenger train traffic as a whole formed 82·46 per cent. of their total railway receipts, and, exclusive of season ticket holders, they carried during the year 2,904,000 passengers or 159,000 more than in 1933 for nearly £1,500 less money. Regarding goods train traffic, their receipts from general merchandise decreased by over £500 or 3·29 per cent., although the quantity carried was greater by nearly 740 tons, but both the tonnage and the receipts from coal and other minerals showed small increases.

In regard to expenditure the time had probably now arrived when it might not be possible to carry out further material economies which would be consistent with proper maintenance and efficiency. Expenditure on railway working showed an increase of nearly £1,500. This was due, to a certain extent, to larger coal consumption owing to an increase of about 13,000 train-miles, but mainly to the greater cost of maintenance of permanent way, locomotives and carriages.

Their road motor undertakings showed reasonably satisfactory results both as to passengers and goods. The bus services, although showing a reduction of over £300 in gross receipts, had resulted in a profit of £1,218, while the net revenue from goods lorries was only very slightly less. The hotel and refreshment rooms department again showed favourable results, the profit of the year amounting to £4,527, or nearly £1,400 more than in the previous year.

In December, 1933, the Chairman and Managers of the Northern Ireland railway companies were granted an interview with the Prime Minister and other representatives of the Government, when the precarious financial position of the companies, owing to uneconomic road motor competition and other causes, was fully discussed and considered. Subsequently the Government invited Sir Felix Pole to investigate the problem of Northern Ireland transport. Sir Felix Pole reported to the Government in June, and recommended that the railways should continue to be operated as at present, but that a Road Transport Board should be constituted and empowered by Act of Parliament to take over all passenger and goods road motor services in Northern Ireland, including those operated by the railway companies, and that the board and the railway companies should be required to enter into an arrangement for pooling the gross traffic receipts derived from both the railway and road services after deducting certain agreed expenditure, the proposal being that the share of the railway companies in the pool should be compiled on the basis of a moiety of the receipts of each railway company for the years 1924 and 1932, and the receipts of the road transport companies for the year 1932 only.

The Government of Northern Ireland had intimated that it had been agreed to adopt in principle Sir Felix Pole's report and that a bill would be introduced in Parliament to provide the necessary legislation. It was understood that the bill would come before Parliament during the session commencing on March 12 next. The scheme appeared to constitute a bold and carefully thought out attempt to solve a very difficult problem.

At their last meeting he had informed them that the whole of the Bangor line had been equipped with automatic electric signalling with the exception of Holywood station. He was now in a position to state that the necessary work at that station was completed during the year.

The 10 per cent. deduction in salaries and wages which had been in operation since 1927 was renewed by the Irish Railway Wages Board for a further period of 12 months as a result of an application made by the company on February 18. He wished to express to the officers and staff generally the directors' appreciation of their services.

The report and accounts were adopted.

Londonderry & Lough Swilly Railway Company

Mr. I. J. T. Colhoun (Chairman of the company), presiding at the annual general meeting at Londonderry on February 28, said that the past year had been one of great anxiety, because the staple traffics on which the railway depended principally continued at a very low ebb. Gross traffic receipts from the railway amounted to £24,747, compared with £19,320 in 1933—the strike year—and £31,200 in 1932. Expenditure on railway working amounted in 1934 to £29,138, against £26,865 in 1933, and £35,121 in 1932, leaving losses on working of, respectively, £4,391, £7,545, and £3,921. To these losses must be added interest and other charges, which, after allowing credit for certain miscellaneous receipts, brought the gross loss up to £5,777 in 1934, £8,779 in 1933, and £5,210 in 1932. Up to and including 1933 these losses were liquidated by grants from the Governments of the Irish Free State and Northern Ireland, but no financial assistance of this type was received during 1934.

In view of this situation and the uncertain outlook the directors found it necessary to ask the staff to accept a temporary reduction in wages. This course was taken very reluctantly. Despite this reduction they were still paying a rate of wages to even the lowest paid grades well above the average rates prevailing even in public services in the district served by the company. They could not continue indefinitely incurring heavy losses in railway working in the absence of financial assistance.

On the other hand, it was gratifying to note that their receipts from their road passenger services had risen from £38,435 in 1933 to £38,956 in 1934. This increase rose mainly from the fact that they developed tourist and excursion traffic by road. He was very hopeful that, with the benefits of the legislation now available, they would ultimately emerge on a sound economic footing.

The report and accounts were adopted.

QUESTIONS IN PARLIAMENT

Railway Electrification and Coal Saving

Mr. North on February 28 asked the Secretary for Mines if he could give any estimate of the reduction in the quantity of coal required annually by the railway companies of this country if they were to electrify their main lines.

Mr. Ernest Brown.—The Committee on Main Line Electrification, which reported in 1931, estimated that in the event of the electrification of the railways, the amount of coal required for the production of the necessary electricity would be about 3,650,000 tons. On the basis of present coal consumption by railway locomotives, this would represent a net reduction in coal consumption of rather more than 8 million tons.

Charing Cross Bridge

Mr. Vyvyan Adams asked the Minister of Transport what were the plans of the Government for the replacement or reconstruction of Charing Cross Bridge.

Mr. Hore-Belisha.—I recently asked the London and Home Counties Advisory Committee to review the case for safeguarding the possibility of constructing a road bridge in the neighbourhood of Charing Cross, in so far as such case rests upon considerations of traffic.

Railway Fruit Traffic in Palestine

Mr. Janner asked the Secretary of State for the Colonies whether he was aware that, in consequence of the inadequate supply of closed goods wagons on the Palestine railways, exporters of citrus had recently been compelled to load their fruit in open wagons; and what steps were being taken to ensure an adequate supply of covered wagons before the next citrus exporting season, in view of the fact that there would be an increased crop to handle.

Sir P. Cunliffe-Lister. — Attention was drawn to the shortage of covered wagons by a committee which was appointed early last year by the High Commissioner for Palestine to investigate traffic requirements. The committee recommended the provision of 100 additional covered wagons, inclusive of 40 already authorised for traffic in 1934-5, and the immediate purchase of these vehicles was approved.

Captain Strickland asked the Secretary of State for the Colonies whether he was aware that, owing to the fact that the loading sheds at the railway stations of Hedera, Rehoboth, and Petah Tiqvah, were not completed until after the heavy rains which occurred in January, many thousands of boxes of Palestine citrus fruits were spoiled by rain and mud; and whether he could give an assurance that adequate facilities would be provided at the various Palestine stations concerned before next winter.

Sir P. Cunliffe-Lister.—This matter was considered last year by a committee which was appointed by the High Commissioner for Palestine for the purpose of investigating traffic requirements. The committee recommended that the Government should construct orange storage sheds at the main centres, charging a storage fee sufficient to reimburse the capital cost and annual charges, and that the larger citrus growers should be encouraged to provide their own sheds and to connect these sheds by private sidings to the railway. Following a recommendation of committee, approval was given for increasing by 50 per cent. the size of the sheds which had already been built or were to be built at Petah Tiqvah, Rehoboth and Hedera, and for the construction of sheds at Jaffa and Tel-Aviv. I have no recent reports on this matter, but I am sure that the Palestine Government will endeavour to provide accommodation to the extent recommended by the committee at the earliest possible date.

The Law and Level Crossings

Rear-Admiral Sir Murray Sueter asked the Minister of Transport whether, in view of the legal position in regard to level crossings as it affects the Wormley, Herts, railway accident, which position was stated in the case of Jenner *v.* South Eastern Railway Company, as reported in 105 Law Times Reports, page 131, he would take the matter up with the L.N.E.R. to see that the company discharged its duty in the interests of the public.

Mr. Hore-Belisha.—I am already in communication with the company.

Liverpool Street to Leyton Traffic

Sir Wilfred Sugden asked the Minister of Transport what action he was taking to provide proper facilities for the travelling public by the L.N.E.R. from Liverpool Street to Leyton between the hours of 5 p.m. and 7 p.m. during the working days of the week; and if he was aware of the increased danger arising through the present overcrowding of the carriages in this section at those times.

Mr. Hore-Belisha.—Parliament has not conferred upon me any powers of control over the travelling facilities to which my hon. friend refers. No instance of danger has been brought to the notice of the company or myself.

Agreed Charges

Mr. Noel Lindsay asked the Minister of Transport how many agreed charges had been referred to the tribunal under Section 37 of the Road and Rail Traffic Act, 1933; and how many had been approved.

Mr. Hore-Belisha.—271 applications (including applications for approval for a further period) have been made to the Railway Rates Tribunal for the approval of agreed charges, 229 applications have been approved, 4 have been withdrawn, and 38 have yet to be heard.

Mileage of Canals

Mr. Tinker asked the Minister of Transport if he could state how many miles there were of waterways, canals, &c., that were formerly used for carriage of goods that were no longer used and had fallen into disuse; and could he say if his department had any plans in consideration of what shall be done with them.

Mr. Hore-Belisha.—I regret that I am unable to state what mileage of canals or inland waterways, which have at some time been used for the carriage of goods, are no longer used. In cases where waterways have ceased to be used for navigation, they are often required for drainage purposes, but otherwise their utilisation or disposal is a matter primarily for the site owners.

Punctuality Day on the L.M.S.R.

Last Tuesday a punctuality day was held by the L.M.S.R., when a special survey was made of the timekeeping of all passenger trains. A total of 13,497 trains were covered by this survey, which extended from midnight to midnight, and in the aggregate 98·9 per cent. of these trains arrived punctually, or not more than five minutes late. Of 629 express trains, the percentage punctual was 98·3 per cent.; of 10,344 local trains, 98·8 per cent.; and of 2,524 electric trains, 99·3 per cent. The Scottish, or Northern, Division actually attained 100 per cent. punctuality of express trains and 99·9 per cent. punctuality of local trains, while the Central Division attained 99·1 per cent. for expresses, 99·3 for local trains, and 99·5 for electric trains. Whole-hearted efforts were made by the staff to support the Chief Operating Manager in securing the best possible results from the test which, although undertaken primarily as a measure of routine, is nevertheless expected to yield valuable data in regard to a variety of operating questions. Among a number of notable achievements in maintaining punctuality when trains had been delayed by causes outside their control, may be mentioned the case of the 10.25 a.m. express from London (St. Pancras) to Manchester. Owing to a broken drawbar, this train was 15 minutes late in starting from St. Pancras, but nevertheless arrived at Derby one minute before time, the 128½ miles having been covered in 136 minutes, including stops at Leicester (3 min.) and Loughborough (1 min.). The 99 miles from St. Pancras to Leicester were covered in 97 minutes, at an average speed of 61·2 m.p.h. The train was hauled by a standard 3-cylinder 4-6-0 engine, No. 5656.

XUM

A World's Record on the L.N.E.R.

A maximum speed of 108 m.p.h. attained, and 536½ miles run by one locomotive at an inclusive average of 70·4 m.p.h. on a test journey from London to Newcastle and back

On Tuesday last, March 5, records were achieved by the London & North Eastern Railway, in the course of an experimental high speed run from King's Cross to Newcastle and back, which have never previously been equalled in the history of steam locomotion. There are various records associated with railways, chiefly American, which claim that very high speeds have been attained, but practically all of these in which speeds of over 100 m.p.h. have been asserted—with the exception of the recent journey over the Chicago, Milwaukee, St. Paul & Pacific RR. from Chicago to Milwaukee—lack the corroboration of any scientific data sufficient to permit of their acceptance as authentic records. In many cases the times quoted were merely taken to the nearest minute over very short distances, with a wide margin of possible error in the speeds so calculated.

But the maximum speeds realised in the descent of Stoke bank, on the up journey of last Tuesday, were established by a number of observers, and had the continuous check of the dynamometer car record, so that no doubt can exist as to the precise accuracy of the speeds recorded. In brief, the 12·3 miles from Corby to Tallington were run in 7 min. 20 sec., at an average speed of 100·6 m.p.h., and the 3·6 miles from Little Bytham to Essendine in 2 min. 3 sec., at an average of 105·4 m.p.h., while the maximum rate was 108 m.p.h., between Little Bytham and the 91st mile-post, which marks the foot of the 1 in 200 gradient. It is remarkable, moreover, that an average of 100·6 m.p.h. continued from Essendine to Tallington, notwithstanding the fact that the gradient is here flattening, being partly at 1 in 264 and partly at 1 in 440. For the complete 20·6 miles from Stoke Summit to Werrington, begun at 69 m.p.h., and finished at about 80, the average was 93·9 m.p.h., and one of the most notable features of the running was the acceleration from 69 to 97¾ m.p.h. down no more than 3 miles at 1 in 178 from Stoke to Corby. It may be added that the riding of the coaches was very smooth at these high speeds.

DESCENT FROM STOKE SUMMIT TO WERRINGTON JUNCTION

	Distance	Time	Station to Station Average
	miles	min. sec.	m.p.h.
Stoke Box	0·0	0 00	—
Corby	3·0	2 12	81·8
Little Bytham	7·9	5 13	96·9
Essendine	11·5	7 16	105·4
Tallington	15·3	9 32	100·6
Helpston Box	18·2	11 27	90·8
Werrington Junction ..	20·6	13 10	83·9

Corby to Tallington, 12·3 miles in 7 min. 20 sec. = 100·6 m.p.h.
Stoke to Werrington, 20·6 miles in 13 min. 10 sec. = 93·9 m.p.h.

It is also a matter of considerable note that these speeds were attained after the engine concerned in the trials—Super-Pacific No. 2750, *Papyrus*—had already travelled well over 400 miles in the one day at extremely high speeds throughout; and if this were not enough, the driver then went on to complete the fastest times ever yet recorded from Grantham and Peterborough to King's Cross, 83 min. 6 sec. for the 105·5 miles from the former town, and 62 min. 5 sec. for the 76·4 miles from the latter into the terminus. This included the exceptional time of 20 min. 17 sec. for the 27·0 miles, largely uphill, from Huntingdon to Hitchin, which began with a speed restricted to 70 m.p.h. over the Offord curves. The lengthy climb to Stevenage, finishing with 5 miles up at 1 in 200, was surmounted at a speed which did not vary more than between 80 and an absolute minimum of 78¼ m.p.h. On the completion of the test, the engine had covered 536·6 miles in an actual time of 468 min. 55 sec., made up of 237 min. 7 sec. going north and 231 min. 48 sec. coming south. But of this total an unforeseen check through Arksey, owing to a mishap to a coal train on the up road through the station, caused a loss of fully 7 min. in the down direction, and a little under 4½ min. in the reverse direction, leaving a net time of 230 min. down and 227½ min. up, or 457½ min. in all. This works out at a net average of 70·4 m.p.h. maintained by the one locomotive over more than 7½ hr. of a single day, in the course of 536·6 miles of running, and inclusive of a considerable number of service speed restrictions, some of which (at Peterborough, Selby, York and Durham) are very severe. Nothing even remotely approaching such a feat has ever been achieved previously by a steam locomotive.

The test train consisted of dynamometer car, restaurant car, three first-class coaches and a first-class brake, six coaches in all, weighing empty 209¾ tons behind the engine tender, and providing in all 204 passenger seats. With the small passenger complement, staff, and stores on the test runs the total weight was 213 tons. The engine, No. 2750, *Papyrus*, is one of the Pacific series using steam at 220 lb. per sq. in., and in comparing this run with those made between London and Leeds on November 30 last, it seems clear that the high pressure engine had an advantage over the 180-lb. engine used on the previous test, especially in the matter of free running downhill. No. 2750 was built in 1928, and has been in service for seven years; it had run 392,853 miles up to the time of the test, and had been running for about two months since the last periodic overhaul. No special preparations were made for the run other than to arrange a suitable path for the test trains, and to ensure that, as far as was possible, the road should be kept clear. On this occasion, also, the drivers were instructed to adhere fairly closely to their schedule, except that a little latitude was allowed south of Grantham on the up journey, of which the driver took full advantage. There were various indications, at different stages of both runs, that the engine was being eased in order to avoid gaining too much time, and the rapid recovery from the out-of-course slowings through Arksey showed that even these schedules, calling for an average rate of 67 m.p.h. throughout between London and Newcastle in both directions, allowed plenty of recovery margin.

The times of the journeys are set out fully in the tables annexed. On the continuous 1 in 200 from Wood Green up to Potter's Bar the engine accelerated from 72 to 74½ m.p.h., but owing, apparently, to premature notching up, speed fell to 64 m.p.h. before the summit was reached. Speed averaged 84·4 m.p.h. over the 25 miles between mile-posts 29 and 54, and reached a maximum of 88½ m.p.h. at Three Counties, after which a reduction to 70 m.p.h. was made over the Offord curves. Notable work was performed on the ascent to Stoke; No. 2750 went up the 1 in 200 to near Corby at a minimum of 75 m.p.h.; the level strip through Corby station raised speed to 78 m.p.h., and the minimum on the final 3 miles at 1 in 178 was 75 m.p.h. The complete 13 miles of the ascent were thus run in 10 min. 13 sec., at an average of 76·3 m.p.h. After this there were no further features of note until after the slowings and stop between Doncaster and Arksey. From these the engine recovered speed with remarkable rapidity, attaining 85 m.p.h. in 8 miles of level track which had been commenced practically at a walking pace. Another fine achievement was over the

CLIMB FROM ESSENDINE TO STOKE SUMMIT

	From Post to Post	
	Time Sec.	Average m.p.h.
Mile-post 87	—	—
,, 88	47·4	75·9
,, 89	47·8	75·3
,, 90	46·6	77·2
,, 91	46·4	77·5
,, 92	46·6	77·2
,, 93	47·2	76·2
,, 94	47·2	76·2
,, 95	48·0	75·0
,, 96	48·0	75·0
,, 97	46·8	76·8
,, 98	46·0	77·9
,, 99	47·2	76·2
,, 100	47·8	75·3

13 miles in 10 min. 13 sec. = 76·3 m.p.h.

L.N.E.R. Experimental Runs, King's Cross to Newcastle and Back
March 5, 1935

Engine: 4-6-2 No. 2750, *Papyrus*.
Load: 6 coaches, 209¾ tons, 213 tons gross.

DOWN JOURNEY Driver: H. Gutteridge. Fireman: A. Wightman						UP JOURNEY Driver: W. Sparshatt. Fireman: R. Webster.			
Distance	Schedule	Actual	Speeds‖	Station		Distance	Schedule	Actual	Speeds‖
miles	min.	min. sec.	m.p.h.			miles	min.	min. sec.	m.p.h.
0·0	0	0 00	—	KING'S CROSS .. .		268·3	240	231 48	—
2·5	—	4 47	—	FINSBURY PARK		265·8	—	227 58	—
5·0	—	7 11	72	Wood Green		263·3	—	225 54	81½
9·2	—	10 41	74½	New Barnet		259·1	—	222 52	85
12·7	—	13 42	64	Potter's Bar		255·6	—	220 12	77½
17·7	19	18 03	80§	HATFIELD		250·6	223	216 23	85§
23·5	—	22 48	68	*Woolmer Green*		244·8	—	211 52	71½
25·0	—	24 08	76½	Knebworth		243·3	—	210 36	80½
28·6	—	26 48	76½	Stevenage		239·7	—	207 53	78½
31·9	30	29 19	82½	HITCHIN		236·4	212	205 17	79
35·7	—	31 57	88½	Three Counties		232·6	—	202 28	85
37·0	—	32 53	83½*	Arlesey		231·3	—	201 31	80*
41·1	—	35 47	85	Biggleswade		227·2	—	198 29	85½
44·1	—	37 53	83¾	Sandy		224·2	—	196 23	87½
47·5	—	40 16	86	Tempsford		220·8	—	194 02	85½
51·7	—	43 19	82½	St. Neot's		216·6	—	191 07	76½
56·0	—	46 28	70¶	Offord		212·3	—	187 31	71½¶
58·9	50	48 52	78½	HUNTINGDON		209·4	191	185 00	75
63·5	—	52 30	74½†	Abbot's Ripton		204·8	—	181 16	72
69·4	—	56 40	86½	Holme		198·9	—	176 47	83½
72·6	—	59 14	71	Yaxley		195·7	—	174 18	72
75·0	—	61 15	—	*Fletton Junction*		193·3	—	172 07	—
76·4	66	63 21	201¶	PETERBOROUGH		191·9	175	169 43	22¶
79·5	—	67 13	73½	*Werrington Junction*		188·8	—	166 26	—
81·9	—	69 05	80	*Helpston*		186·4	—	164 43	—
84·8	—	71 19	—	Tallington		183·5	—	162 48	98½
88·6	—	74 20	75½	Esserdine		179·7	—	160 32	102
—	—	—	77½	—		—	—	—	108
92·2	—	77 05	77	Little Bytham		176·1	—	158 29	106
97·1	—	80 58	75½	Corby		171·2	—	155 28	91
100·1	—	83 21	75½	*Stoke*		168·2	—	153 16	69½
102·0	—	84 52	76	Great Ponton		166·3	—	151 36	70½
105·5	92	87 42	64¶	GRANTHAM		162·8	149	148 42	71½
109·7	—	91 16	79	Barkstone		158·6	—	144 37	59½
115·4	—	95 32	83½	Claypole		152·9	—	139 37	—
120·1	103	99 10	—	NEWARK		148·2	137	135 52	77
126·4	—	104 23	76½	Carlton		141·9	—	130 51	75
131·3	—	108 34	62½	Dukeries Junction		137·0	—	126 59	72½
133·7	—	110 53	64	*Markham*		134·6	—	124 56	64½
135·5	—	—	80	*Garston*		132·8	—	123 13	—
138·6	119	115 18	58¶	RETFORD		129·7	122	120 25	78½
143·9	—	120 11	75	Ranskill		124·4	—	116 24	80½
145·8	—	121 42	77½	Scrooby		122·5	—	114 55	86½
147·7	—	123 13	72½	Bawtry		120·6	—	113 33	81½
149·5	—	124 46	69½	*Mile-post* 149½		119·0	—	112 12	72
153·2	—	127 39	80	*Black Carr Junction* ..		115·1	—	109 13	77½
		sigs.							
156·0	133	132 00	5¶	DONCASTER		112·3	107	106 40	53
		sig. stop	0¶					*p.w.s.*	15
158·1	—	138 30	—	Arksey		110·2	—	103 13	16¶
								p.w.s.	
160·2	137	141 01	68½	*Shaftholme Junction* ..		108·1	103	99 03	—
163·0	—	143 20	77½	Moss		105·3	—	96 38	74½
166·0	—	145 31	85	Balne		102·3	—	94 19	79
169·8	—	148 15	83½	Templehirst		98·5	—	91 15	72½
173·0	—	150 35	86½	*Brayton Junction*		95·3	—	88 33	—
174·4	150	152 05	38¶	SELBY		93·9	89	86 38	32¶
178·5	—	156 19	77	Riccall		89·8	—	82 24	73
181·1	—	158 21	80	Escrick		87·2	—	80 18	75
184·0	—	160 28	83½	Naburn		84·3	—	77 55	65
186·2	—	162 25	52¶	*Chaloner's Whin Junction* ..		82·1	—	75 31	—
188·2	164	165 11	231¶	YORK		80·1	75½	72 17	19½¶
189·8	—	168 25	64½	*Poppleton Junction*		78·5	—	69 40	80
193·7	—	170 38	79½	Beningbrough		74·6	—	66 48	82½
199·4	175	174 40	83	Alne		68·9	65	62 43	84½
201·6	—	176 21	82½	Raskelf		66·7	—	61 12	88
204·3	—	178 22	80½	Pilmoor		64·0	—	59 18	86
206·2	—	179 49	80	Sessay		62·1	—	57 58	82½
210·4	185	182 50	85	THIRSK		57·9	56½	54 53	84½
214·8	—	185 55	82½	Otterington		53·5	—	51 48	81½
218·2	191	188 34	79½	NORTHALLERTON		50·1	50½	49 15	80
221·9	—	191 24	81½	Danby Wiske		46·4	—	46 31	87
227·1	198	195 17	76	*Eryholme*		41·2	43	42 52	78½
229·7	—	197 28	68½	Croft Spa		38·6	—	40 58	81½
232·3	203	199 49	67	DARLINGTON		36·0	38½	38 53	70½
237·7	—	204 39	62	Aycliffe		30·6	—	34 04	63¶
242·4	—	208 42	73	Bradbury		25·9	—	30 23	84
245·2	215	211 02	65¶	FERRYHILL		23·1	26½	28 12	74½
247·2	—	213 02	68	*Tursdale Junction*		21·1	—	26 18	—
250·1	—	215 36	64	Croxdale		18·2	—	23 27	—
		p.w.s.	45¶					*p.w.s.*	47¶
253·3	—	219 27	—	*Kelly Mill Junction* ..		15·0	—	19 58	39½
254·3	225	221 07	32¶	DURHAM		14·0	‡17	18 07	31¶
255·7	—	222 50	—	*Newton Hall Junction* ..		12·6	—	16 25	—
258·2	—	225 28	66	Plawsworth		10·1	—	13 15	—
								p.w.s.	34¶
260·1	—	227 01	75	Chester-le-Street		8·2	—	11 02	68½
262·9	233	229 23	70½	Birtley		5·4	8	8 22	62½
		p.w.s.	46¶					*p.w.s.*	
265·8	—	232 28	—	Low Fell		2·5	—	5 03	57
267·7	—	235 10	24¶	*King Edward Bridge Junction*		0·6	—	2 35	—
268·3	240	237 07	—	NEWCASTLE		0·0	0	0 00	—

* Speed at Langford (38½ mile-post).
† Minimum at mile-post 62.
‡ Speed at top of 1 in 200 (95½ miles); increased to 78 at 97 miles.
§ At Lea Valley (19 mile-post).
‖ The figures given in speed columns indicate maximum or minimum speeds at or near the stations shown.
¶ Indicates speed reduced by brakes for service, permanent way or signal checks.
p.w.s. Permanent-way slow.

level stretch of line from York to Darlington, where the 39 miles between mile-posts 3 and 42 were covered in 29 min. 14 sec., at an average of precisely 80 m.p.h., notwithstanding the fact that the tendency of the road in this direction is against the engine—there are 12 adverse miles at 1 in 629-740—and that there was a pronounced easing round the curves from mile-post 39 (Eryholme) onwards. Of the down journey a total of approximately 120 miles was covered at an average rate of 80 m.p.h.

On the up journey good use was made of the level stretch across the Great Plain of York, the 55·4 miles from Ferryhill to Poppleton junction, just north of York, being covered in 41 min. 28 sec., at an average of 80·2 m.p.h., despite a slackening round the curves at Aycliffe. Speed did not fall below 80 m.p.h. at any point from mile-post 38 to mile-post 2, and between posts 40 and 2 (38 miles) averaged 83·4 m.p.h., with a maximum of 88 on the level. From York onwards the engine, which had gained 5 min. on schedule from Ferryhill, was eased somewhat, and the time then in hand compensated for the bad slowing through Arksey, for reasons previously mentioned, so that the train passed Doncaster on time. Time was then closely adhered to as far as Grantham, where the engine was blowing off slightly. The exceptional features of the running from Grantham to King's Cross have been described already. On arrival at King's Cross the engine was found to be perfectly cool.

The train was in charge of Mr. V. M. Barrington-Ward, Superintendent, Western Section, Southern Area; and among others on board, were:—

Mr. S. T. Burgoyne, Passenger Manager, North Eastern Area; Mr. C. J. Brown, Engineer, Southern Area; Mr. John Miller, Engineer, North Eastern Area; Mr. O. Bulleid, Assistant to the Chief Mechanical Engineer; Mr. I. S. W. Groom, Locomotive Running Superintendent, Southern Area; Mr. C. M. Stedman, Locomotive Running Superintendent, North Eastern Area: Mr. J. C. L. Train, Assistant Engineer (Maintenance) Southern Area; Mr. F. E. Harrison, Assistant Engineer, North Eastern Area; Mr. C. R. Francis, Press Section; Mr. Ashley Brown; Mr. Norman D. Macdonald; and Mr. Cecil J. Allen, who was charged by Mr. Barrington-Ward to time the train.

(*See editorial article on page* 424)

L.N.E.R. Record Run.—The locomotive *Papyrus*, which hauled the record-breaking train from London to Newcastle and back last Tuesday, as described above, was fitted with Wakefield's mechanical lubricators for valves and cylinders and coupled-axle boxes. Wakefield's superheater cylinder oil and express engine oil were used.

The Jubilee Stamps.—It is interesting to note that the view of Windsor Castle shown on the forty-four Crown Colonies Jubilee stamps is that seen from the train on the G.W.R. Reading-Paddington main line. The design is confined to the Crown Colonies, as the Dominions and Protectorates have their own motifs. The picture is a happy one, as it will be the view known to most British subjects overseas.

XUM

MINISTRY OF TRANSPORT ACCIDENT REPORT

Port Eglinton Junction, Glasgow; London Midland & Scottish Railway: September 6, 1934

The accompanying diagram is reproduced from the report by Lt.-Col. Mount on this collision. The two trains concerned were the 5.35 p.m. passenger train from St. Enoch to Kilmarnock, which, after travelling on the up main line, was being crossed on to the up fast Canal line, and the 5.12 p.m. passenger train from Paisley to St. Enoch, which was running on the down fast Canal line. There is no doubt that the signals were against the latter train, so that both met, practically head-on, with the result that six passengers and three of the four enginemen lost their lives; the driver of the Paisley train was the surviving engineman. Both locomotives were tender engines of the 4-4-0 type; the Paisley train engine was running tender first, with the driver standing on the right-hand side in the direction of travel. The weather was fine, with good visibility.

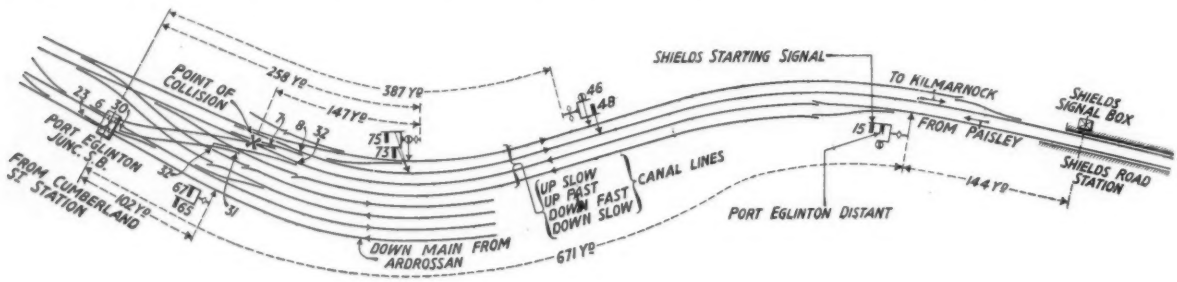


Diagram showing point of collision

From Shields Road station, the gradient of the down Canal line rises 1 in 200 for 583 yd. to the site of the collision, and thence, past Port Eglinton Junction box, at 1 in 86 up to near the west end of Cumberland Street station. Approaching from Shields there is also heavy reverse curvature, first, left-handed for 262 yd. on radius of 21 ch., followed by tangent for 110 yd., and, secondly, right-handed for 258 yd. on radius of 12·5 ch. to the site of collision.

Owing to the above-mentioned reverse curvature, somewhat unusual conditions prevail with regard to the view which a driver obtains of signals when approaching the junction from Shields Road over the down fast Canal line. For the purpose of noting these conditions, Colonel Mount travelled on two occasions on the footplate of a similar engine, running tender first. The driver's position is on the right-hand side of the footplate in the direction of travel, *viz.*, on the side on which are located the down homes Nos. 73-75, and the up starters Nos. 46-48.

At a point 35 yd. in advance of the Shields down advanced starting signal, No. 15, these four signals come into view more or less simultaneously with the down main homes Nos. 65-67; and, surprisingly, the last named appear on the right, while up signals Nos. 46-48 are in the middle higher up, and Nos. 73-75 appear to the left lower down. The relevant subsequent changes in the positions of these signals, as seen by the driver while approaching them, are as follows: At a point 35 yd. further on, *viz.*, 214 yd. before reaching up signals Nos. 46-48, the diamond-shaped Rule 55 plates on the post of these signals passed across the line of vision of Nos. 73-75; and it was not until after travelling a further 152 yd. that these plates, which were so prominently displayed, cleared the line of vision of signals Nos. 73-75.

Briefly, the line of vision of signals Nos. 73-75 was more or less affected while traversing a distance of about 152 yd. between points 343 yd. and 191 yd. before reaching them. Thereafter, the view of these signals is quite uninterrupted, *viz.*, over a distance in rear of them of 191 yd., though, curiously enough, the down main homes Nos. 65-67, which are 156 yd. ahead of Nos. 73-75, do not assume their true relative position *to the left* until after a point only 62 yd. before reaching Nos. 73-75 is passed.

Over the distance, therefore, of 316 yd. up to this point—62 yd. before reaching signals Nos. 73-75—it is a fact that the view of the signals on the occasion in question, as presented to the driver of the Paisley train, was that *on the right* there was the main line bracket post carrying signals Nos. 65-67, and *on the left* the nearer bracket post carying signals Nos. 73-75 which controlled his movement. When these signals first come into view, Colonel Mount noted some difficulty in realising which post was the nearer of the two, particularly as post Nos. 46-48 is nearer than both.

Sykes' lock and block is in operation between Port Eglinton and Shields boxes, trains being accepted on the fast and slow lines in both directions on plunge instruments. Shields starting signal, No. 15, is released by plunge from Port Eglinton. Port Eglinton up main and Pollok Junction down main starting signals are released by a block plunge, and a second plunge cannot be made on the Port Eglinton down plunger until the first train has cleared the treadle beyond the starting signal, and the home signal slide has been restored to normal, or, alternatively, the treadle locking has been cancelled by the use of the key and the home signal slide has been restored. Further, No. 23 point lever, when reversed, locks the down main plunger, and, conversely, when a train has been accepted from Pollok Junction on the down main, No. 23 lever is locked normal. Point lever No. 23 precedes No. 30, which precedes No. 31 or No. 32. With regard to the other points concerned, No. 8 precedes No. 7, and No. 7 precedes No. 6, while No. 32 requires Nos. 6 and 7.

The following are the relevant instructions which applied to the acceptance of trains at Port Eglinton Junction:—

Sykes' Lock and Block Regulations
Regulation 4

When the down main or down Canal line is clear to this box and the train-out-of-section signal has been given for the preceding train, the Is-line-clear? signal may be acknowledged for the following train.

A down freight train must not be accepted from Shields Box while a train is being crossed from the up main to the up Canal line.

Down trains must not be accepted from Pollok Junction when a crossing movement is being made or about to be made between the down Canal line or Shields Bank sidings and the down main line. The junction points and the block instrument to Pollok Junction are interlocked.

When a crossing movement is being made to or from the Canal and main lines via the junction immediately west of Cumberland Street platforms, the up main line rear home signal must not be cleared to allow a train to draw forward to the inner home signal.

From the first paragraph it appears that acceptance under Regulation 4 is only authorised if the down lines are "*clear to this box*"; but Colonel Mount was informed that since the introduction of the Sykes system here, 30 years ago, the term *box* has in practice been used *collectively*, namely, as covering the area between the junction home signals in each direction. Operation on, for instance, the down fast Canal line has therefore permitted of full *line-clear* acceptance up to sig-

nals Nos. 73-75, even though the road may be set for a fouling movement in rear of what appears to have been the intended clearing point. It will also be noted that exception to this has been made in respect of down freight trains, which have not been so accepted since April, 1928, due to the occurrence of an over-run. Indeed, it appears that the working here has always been looked upon as that of a station yard, a speed restriction of 15 m.p.h. being relied upon on all lines between Clyde Bridge and Port Eglinton Junction; distant signals did not even exist till May, 1933, when fixed semaphores were provided on the down Canal and main lines in connection with the St. Enoch new colour-light scheme.

Driver D. Kerr, who was in charge of the Paisley train, said that after leaving the platform at Shields Road he "turned the reverser up in expansion, and then I saw that the Shields starter was 'clear' and Port Eglinton distant at 'caution.' After that I gave the engine another notch up and, being tender-first, I had a good view over the tender and I saw Port Eglinton down home Canal signal, No. 75, standing 'clear.' Then to get me over the incline into Cumberland Street I turned and opened the second regulator valve and gave the engine a little bit up in the reverse. By this time I would be an engine length from the signal, and when I looked up at it it was at 'danger' and, naturally, I put on the brakes and my first intention was to look over the side and then everything after that was blank."

Kerr said that when he realised that the home signal was at "danger," speed was "rather over 20 m.p.h." He did not see the signal return to "danger." He was standing on the stool in his position on the footplate, in accordance with his custom when running tender-first. He knew there were the two home signals, Nos. 73-75, on a bracket post, and he thought they came into view "more than a train length" after passing the post carrying the Shields advanced starting signal No. 15 and the fixed distant for Port Eglinton; he also said that these signals could be seen "more than a train length" before reaching the up starting signals Nos. 46-48, and that the latter did not, so far as he knew, interrupt their view. Kerr also stated that he knew the down main line home signals Nos. 65-67, and was certain that he did not mistake them for Nos. 73-75; in fact, he said he did not see Nos. 65-67, which he referred to as being "a good distance away and very high." He had done all his firing over this road and knew these signals "thoroughly well." He had signed the route-card as recently as July 10, as a repetition and revision of previous signatures; there is no pressure to do this, and he explained that "if we are not sure of the road we do not sign it."

With regard to his actions immediately before passing the home signals at "danger," Kerr explained that, when notching up and giving more steam, he had to turn his back to the direction of travel, in order to open the regulator with both hands, and that when he turned round again he observed the signal at "danger." "When I notched up the engine I was a good distance off and when I finished I was an engine length from the signal." Kerr added that he then shouted to fireman Goldie (deceased) "That signal was off, Bob" and received the reply "Aye"; though Goldie had just previously been firing after leaving Shields Station, Kerr's impression was that he (Goldie) had also previously observed the signal No. 75 in its "clear" position. Kerr said there was nothing to distract his attention beyond his turn round to open the regulator and notch up the engine, and that he was "concentrating on my ordinary work"; nor was his view restricted in any way over the coal which was levelled down on the tender. His height is 5 ft. 11½ in.; he could stand upright and retain a good view.

On subsequent cross-examination, Kerr estimated that the down home signals, Nos. 73-75, come into view two or three engine lengths after passing Shields starting signal. This is correct, and when asked to describe the view obtained from this position of these signals relative to the main line home signals, Nos. 65-67, and the up Canal starting signals, Nos. 46-48, he replied: "I have a good working knowledge of the signals at this place and know that with the curves the relative view of these varies. I have a difficulty in describing their positions, but know them perfectly well on the ground." He added that he had "no recollection of having seen the main line down home signals (Nos. 65-67) and therefore this had no effect on my view of the down Canal signal. I, however, know both these signals well."

Signalmen R. Murphy and J. Mackay were on duty in Port Eglinton box with Bookmarker J. Gracie. In brief, their evidence was to the effect that nothing unusual in operation happened until, to their dismay, they both observed the Paisley train passing the home signals Nos. 73-75 at "danger," the signals for the Kilmarnock train, up main to up Canal, and for the train from Ardrossan on the down main, being "clear" at the time. Gracie also had his attention drawn to the Paisley train when he heard Murphy call out immediately before the collision occurred: "There's that fellow coming through that signal." Murphy and Mackay emphatically denied the allegation of Driver Kerr that signal No. 75 was first lowered for the Paisley train and then replaced to "danger" previous to the road being set and signals lowered for the Kilmarnock train. They explained, in accordance with Gracie's entries in the register, that the Paisley train was accepted at 5.32 and the Ardrossan train at 5.34. The indication *Train in Section* for the Kilmarnock train appeared on the describer at 5.36.

The conclusions in the report commence with the observation that there is, therefore, definite contradiction in the evidence. The signalmen affirm that they wanted to see how the trains were running before deciding which was to take precedence over the junction, and, therefore, before the signals were cleared. Driver Kerr, on the other hand, alleges that at a point about 380 yd. from home signals Nos. 73-75—at which they first came into view—he observed No. 75 in the "clear" position and that, thereafter, he did not observe the signal again until he reached a point some 20 yd. from it, when he realised that it was at "danger" and made an emergency brake application. In effect, Kerr alleges that signals were reversed and the road changed in front of him and that therefore he was misled.

Colonel Mount makes some calculations to show that such a change was just possible but, in that event, the Kilmarnock train would have been checked. Apart, therefore, he says, from the entirely trustworthy evidence of signalmen Murphy and Mackay, and the fact that the Kilmarnock train was not checked but was evidently running under "clear" signals, there is not the slightest doubt that there was no change of road and that the cause of the accidents was Driver Kerr's unfortunate failure to observe and obey home signals Nos. 73-75 at "danger."

Driver David Kerr is therefore responsible for this serious collision, and notwithstanding his evidence, which was obviously given with sincerity, Colonel Mount feels that he was overconfident with regard to his knowledge of the positions of the signals concerned, and that when they came into view for the first time, with the down main line homes on the right, as already described, he jumped to the conclusion that No. 65, which was "clear," applied to his movement. How deceptive these signals might be has already been described, and, as stated, there was some unnecessary obscuration of Nos. 73-75, which has since been dealt with.

This, however, affords no excuse for a man of experience; nor should Kerr's duties have necessitated taking his eye off the signals concerned for so long a period as perhaps 36 sec. while traversing the distance of no less than 360 yd. It is also difficult to understand why he failed to bring his train to a stand clear of the Kilmarnock train, or why he did not at any rate materially reduce its speed, if he realised the situation as soon as he suggested. The train was travelling at, say, 25 m.p.h., and a stop within perhaps 150 yd. occupying 25 sec., would have prevented the collision. Having regard to Guard Walker's description of the brake application which he said was "*just a swish and a bang; that was all*," this feature also causes doubt as to the reliability of Kerr's account; but perhaps it is

not surprising in view of the shock which he must have sustained.

The question of Guard W. Walker's responsibility also arises. Colonel Mount would not have expected a man of his experience to have been merely tying up letters when approaching an important junction, and particularly the one in question, in view of the curvature of approach; had he been on the alert and fully appreciative of the responsibilities of a passenger guard in such circumstances, he would not have failed to have made himself aware, as soon as curvature permitted it, of the aspect of the home signals. Had he been trying to observe these signals he might have been instrumental in preventing this collision. It seems questionable whether guards, particularly of suburban passenger trains, should be permitted to allow anything to deflect them from the duty of observing signals when approaching junctions and terminals. It is for the company's consideration whether it might not be desirable again to draw the attention of all concerned to this aspect of their duties.

The circumstances of this collision illustrate the necessity for safeguarding the fallibility of drivers in respect of junction operation. There also appear to have been certain previous instances of over-running of the down Canal home signals, and it is not unlikely that the contributory cause, as suggested in this instance, may have been failure on the part of the drivers concerned—after having observed a "clear" down main home signal—to concentrate their attention upon the unusual development of the "pattern" of signals relative to their movements on the down Canal line. With the semaphore installation, as it exists, it is doubtful whether conditions of view can be materially improved; but had the St. Enoch colour-light installation been extended to cover this junction, there would, it may be presumed, have been no chance of misinterpretation, such as that attributed to Driver Kerr.

The fundamental weakness in this case was the method of operation. As described earlier, the practice had existed for many years of down Canal line trains, whether stopping or not at Shields Road station, except goods trains being accepted under Block Regulation 4 up to the home signals Nos. 73-75, while crossing movements were taking place, either up main to up Canal, *e.g.*, the Kilmarnock train, or down main to down Canal.

Though it appears, therefore, by the qualification "clear to this box" in the existing special instructions, that such operation was not authorised, Colonel Mount does not think that signalmen Murphy and Mackay are to be criticised in the circumstances; both gave their evidence particularly well under cross-examination with regard to the alleged change of road. But the procedure which they should have followed is clear. They had accepted three trains, and all were in section and approaching the junction at the same time; as the Paisley train was the first to be dealt with, and was routed along the Canal line, the points should have been left normal for the Kilmarnock train, just as they were locked normal for the Paisley and Ardrossan trains after acceptance of the latter. All three trains would then have approached the junction safely and the Kilmarnock train should not have been permitted to cross the path of the Paisley train until the latter had come to a stand.

While signalman Murphy agreed that it would not be difficult to operate the junction in this manner, he considered that delay would result, particularly at certain other times of the day when similar conditions prevail. After the Ministry of Transport Inquiry, however, arrangements were made to cancel the special instructions in connection with Regulation 4, and to apply standard instructions for junction block working. An investigation with regard to the methods of operation at all junctions in Scotland will, it is understood, be put in hand with a view to uniformity.

At the same time, in connection with an "economy" re-arrangement of signalling which is in hand here, unless it is proposed to make an early extension of the colour-light installation, Colonel Mount thinks it would also be well to re-consider the sighting of the existing down home signals, though, as he has said, it is doubtful whether improvement can be effected.

Another feature, which should not be overlooked in modernising the signalling and operation of this junction, is the retention of so low a speed limit, which it appears drivers may not be strictly obeying. The present restriction of 15 m.p.h. is imposed on all lines in both directions "between north end of Clyde Bridge and Port Eglinton Junction." The latter point also seems ill-defined.

This serious collision, it is observed in conclusion, occurred after a period of nearly a year's immunity from passenger fatality in train accidents. This is one of the longest periods so recorded in the history of British railways, but, nevertheless, discussion has arisen again with regard to the suitability of rolling stock construction for minimising the results of such occurrences. The views which have been formed by the inspecting officers, after full consideration, have already been expressed in the report* upon the accident at Winwick Junction, which unfortunately followed so closely that at Port Eglinton. The progress which the L.M.S. company is making in construction of new rolling stock was also mentioned, and it is appropriate to record the improvement which has been made on this system in recent years in respect of the provision of electric lighting instead of gas. The proportion of the electrically lighted passenger stock, steam hauled, has risen from 52 per cent. at the end of 1928 to 79 per cent. at the end of 1933.

Colonel Mount's final words are in commendation of the company's prompt action to prevent recurrence of such accidents, in this case by the issue of instructions as to modification of procedure at this and other junctions.

* See THE RAILWAY GAZETTE of January 11.—ED. R.G.

L.N.E.R. (King's Cross) Literary Society Smoking Concert

Sir Murrough J. Wilson, K.B.E. (Deputy Chairman, L.N.E.R.), who presided at the annual smoking concert of the L.N.E.R. (King's Cross) Literary Society at the Queen's Hall on Friday, March 1, paid the organisers a well deserved tribute when he said: "This concert here tonight is typical of them; it is well done, it is properly done; it is thoroughly done; in fact, it is like the Literary Society."

The programme last Friday night was planned with a judicious eye to variety. Callender's band, familiar for its broadcast performances, contributed musical pieces, xylophone duets, and cornet solos, and vocal items were rendered by a number of popular artistes. Five humorous turns provided light entertainment which was accorded an enthusiastic reception. Among those present were:—

L.N.E.R.—Sir Charles Batho; Messrs. V. M. Barrington-Ward, C. K. Bird, A. J. Brickwell, C. J. Brown, M. A. Cameron, A. E. Dolden (late Chief Accountant, G.E.R.), P. J. Dowsett, O. C. Gatenby, W. M. Gracie, W. E. Green, S. A. V. Gregory, I. S. W. Groom, R. J. M. Inglis, J. Lees, F. Leigh, J. McLaren, G. Marshall, C. H. Newton, H. S. Owen, W. J. Pepper, A. P. Ross, J. E. Ryan, C. J. Selway, C. F. Slade, G. Sutherland, Percy Syder, F. C. C. Stanley, J. C. L. Train, F. Warriner. *G.W.R.*—Messrs. R. Cope, H. J. Snook. *L.M.S.R.*—Mr. E. Taylor. *L.P.T.B.*—Messrs. A. L. Barber, C. S. Louch, J. P. Thomas. *Southern Railway.*—R. G. Davidson, A. Howie, A. E. Moore.

Other guests included:—

Messrs. J. R. Cheese and H. J. Jewell, of the B. & N. Line; J. P. McClelland, Canadian National Railways; A. Winter Gray and F. A. Crews, Institute of Transport; W. Bennett, Norwegian State Railways; F. Dineen, A. Graham, S. H. James, and S. Lewis, of Pickfords Limited; G. H. Griffith, Pullman Car Co. Ltd.; P. H. Price, Railway Clearing House; J. A. Kay, THE RAILWAY GAZETTE; and C. E. R. Sherrington, Railway Research Service.

Before presenting cups and shields to winners of the billiards, chess, and snooker competitions held by the society during the past year, Sir Murrough J. Wilson, in the course of a short speech, explained that he was deputising for their President, Mr. William Whitelaw.

After thanking the organisers for their efforts, the Chairman expressed his pleasure at being able to welcome so large a congregation, not only of their own railwaymen, but also of visitors from all parts of the country. He welcomed the traders present as

friends who had trusted the railway during very difficult times.

As to the railwaymen, he knew that many of them felt that great demands had been made upon them during the past year, but he could tell them quite candidly that the Directors were going to ask them to do a great deal more. "We have an enormous leeway to make up," he concluded; "there are an enormous number of shareholders who still get no dividends. You will know that we are not really being slave-drivers, but because we do realise that there are a very large number of people in this country who have invested money in the railways and who are getting no return on it, we, as Directors, feel they ought to be getting some return for the money and the confidence they have put into the railways."

Before the end of the concert, a vote of thanks to the Chairman was moved by Mr. V. M. Barrington-Ward, who said that Sir Murrough Wilson had been speaking not only as a director of the company, but also as a man who took a great interest in everything in the railway world.

Railway and Other Reports

Bengal Dooars Railway.—The approximate net earnings for the six months ended September 30, 1934, after allowing for Indian taxation, amounted to £22,946, which, together with £54,673 brought forward from March 31, 1934, £941 for interest and £38 for profit on exchange, makes a total of £78,598. From this amount must be deducted £7,200 for six months' dividend on the preference stock, leaving an available balance of £71,398. The board has declared an interim dividend of 3 per cent. on the ordinary stock on account of the year ending March 31, 1935, subject to United Kingdom income tax (less relief in respect of Dominion income tax), which will absorb £12,000, leaving £59,398 to be carried forward.

Shahdara (Delhi) — Saharanpur Light Railway.—Gross earnings for the half-year ended September 30, 1934, were Rs. 3,95,447, a decrease of Rs. 76,930 or 16·28 per cent. compared with the corresponding period in 1933. Actual operating expenses amounted to Rs. 1,61,842, a decrease of Rs. 5,355, and the operating ratio rose from 35·39 per cent. to 40·93 per cent., and in addition the sum of Rs. 42,500 was again put to depreciation reserve fund. Net earnings were Rs. 1,91,105, a decrease of Rs. 71,575. After allowing for debenture interest and other charges there is a net profit of Rs. 45,632 (against Rs. 73,618), which added to the amount brought forward (Rs. 6,63,364) gives an available total of Rs. 7,08,996. The directors recommend a dividend at the rate of 6 per cent. per annum, free of income tax, costing Rs. 45,000, leaving Rs. 6,63,996 to be carried forward. For the two preceding half-years dividends were at the rate of 7 per cent.

NOTES AND NEWS

L.M.S.R. Station Renamed.—Butterley L.M.S.R. station (Derbyshire) is to be renamed Butterley for Ripley and Swanwick.

Tilbury's Busy Year.—During the past year the L.M.S.R. ran 666 special trains to or from London in connection with 707 liners dealt with at Tilbury—an increase of 25 trains and 40 ships compared with the traffic dealt with in 1933.

100 m.p.h. in Italy.—One of the new railcars on the Italian State Railways attained a speed of 162 km.p.h. (100·6 m.p.h.) when running downhill on the occasion of some recent trials, and maintained 142-150 km.p.h. (87—93 m.p.h.) for some distance.

Further G.W.R. Buffet Car Facilities—As from Sunday last, March 3, buffet-car facilities are provided by the G.W.R. on the 4.10 p.m. train from Paddington to Birmingham (Snow Hill), and on the 8.20 p.m. from Birmingham to Paddington.

Locomotive Sanding Gear and Track Circuit.—The new 2-6-2 tank locomotives for the L.M.S.R., described on page 436, are fitted with the mechanical trickle type of sanding gear, and, in addition, a water de-sanding apparatus is so arranged as to come into action simultaneously with the application of the sand to the rails. Therefore, after the engine has used sand in the forward or reverse direction, the rails are automatically cleaned with hot water, thus obviating the risk of interference with track circuit.

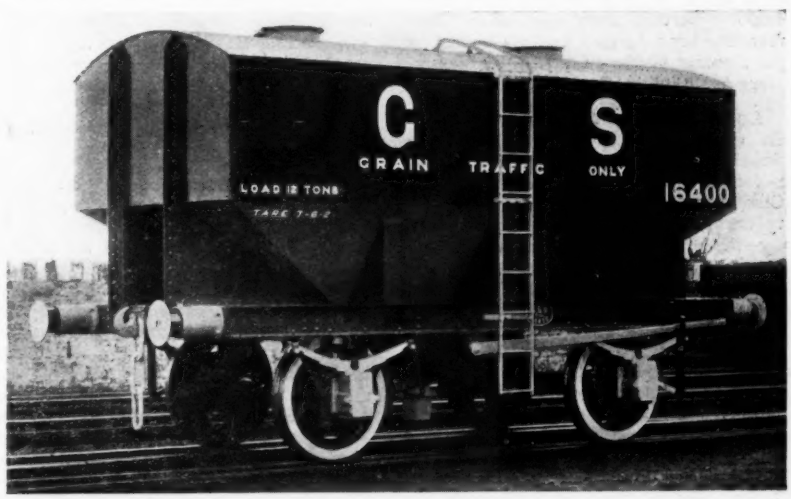
Air-Conditioned Trains on the Pennsylvania Railroad.—By next summer all through trains on the east to west services of the Pennsylvania Railroad will be completely air-conditioned. At present there are 272 cars on this system which are equipped with air-conditioning plant and 78 more are now being fitted. The Pullman Company is raising its quota of air-conditioned cars assigned to the Pennsylvania Railroad to 537. It is pointed out that, while air-conditioning makes its most popular appeal in the summer, it is an all-year process, including the scientific regulation of both temperature and humidity and the circulation through the car of a constant supply of filtered clean air. As the windows are kept closed dirt is excluded and quiet secured.

Road Accidents.—The Ministry of Transport return for the week ended March 2 of persons killed or injured in road accidents is as follows:—

	Killed		Deaths resulting from previous accidents		Injured	
England	65	(79)	23	(23)	2,938	(2,927)
Wales ...	4	(4)	2	(1)	122	(102)
Scotland	7	(13)	4	(1)	274	(322)
	76	(96)	29	(25)	3,334	(3,351)

The total fatalities for the week were, therefore, 105, as compared with 121 for the previous week.

Irish Wagons for Conveyance of Grain in Bulk.—Twelve hopper grain wagons of 12 tons capacity, similar to that shown in the photograph reproduced, have been constructed at the Inchicore works of the Great Southern Railways, Ireland, for the conveyance of grain in bulk. They will be loaded by gravity through two filling holes on the roof, which are fitted with watertight hinged covers. The design of the body is such that the load is self-trimming and discharge is effected through a 6-in. square outlet at the bottom, operated by a screw and lever from the side, suitable hoppers being placed between the rails to receive the grain. The body and underframe are constructed of Dalzo rust-resisting steel. The body sides are $\frac{5}{16}$ in. thick, the



A 12-ton bulk-grain wagon built by the Great Southern Railways, Ireland

XUM

roof plates ⅛ in., and the underframe solebars and headstocks of 9 in. by 3 in. channel section. All joints in the body are electrically welded, and rivets are used only in the gussets and stays. The drawgear, wheels and axles are to Railway Clearing House standards and self-contained buffers are fitted. A ladder is provided on one side of the body for access to the roof during filling operations. The principal dimensions are :—

Length over buffers ...	19 ft. 11 in.
Length over body ...	16 ft. 11 in.
Width of body	7 ft. 10 in.
Wheelbase	9 ft. 6 in.
Diameter of wheels ...	3 ft. 1½ in.
Size of journals	9 ft. by 4¼ in.
Overall height	11 ft. 2⅞ in.
Load	12 tons
Tare	7 tons 6 cwt.

Drumm Battery Trains.—The service of Drumm battery trains between Dublin (Amiens Street) and Bray has been extended from weekdays only to seven days a week, the weekly mileage

Drumm battery train in regular service near Glenageary, Great Southern Railways, Ireland

of a train thereby being extended to 1,000. Certain tests and trials have recently been carried out on behalf of the Drumm Battery Co. Ltd. by Messrs. Merz & McLellan, Consulting Engineers.

London-Paris Sleeping Cars.—In the course of his speech at the Southern Railway meeting last week, reported elsewhere in this issue, the Chairman made the following reference to the forthcoming sleeping car service by the Dover-Dunkerque train ferry service, which it is hoped to have in operation early in 1936 : "Arrangements have been completed with the International Sleeping Car Company for the running of a through service of sleeping cars between London and Paris, thus providing a means whereby a passenger can leave either capital after dinner or the theatre, sleep undisturbed till he arrives at breakfast time in London or Paris, with the whole day before him for work or play. He can return similarly the next night. By this means, since their double journey will be less tiring, we hope to gain back some of those passengers whom we have now lost to the air."

New Hull-Plymouth Air Service.—On Monday last Provincial Airways inaugurated a new service linking Hull, Grimsby, Nottingham, Leicester, Southampton and Plymouth. Flights are made once daily in each direction, the journey time being 3 hr. 40 min.

American Streamlined Locomotive in Service.—The *Commodore Vanderbilt*, the streamlined Hudson type locomotive of the New York Central Lines, which was briefly described in THE RAILWAY GAZETTE of December 21, 1934, was placed in regular service on February 19 and has been hauling the Twentieth Century Limited.

Progress of Railway Bills.—The Southern Railway Bill was read a second time in the House of Commons on February 27, and referred to the Examiners. A Select Committee will begin on March 19 to consider a group of Bills which includes those of the London Midland & Scottish and London & North Eastern Railways. The Great Western Railway Bill has also been committed.

L.M.S.R. Musical Society.—The L.M.S. Railway (London) Amateur Musical Society will give evening performances at the New Scala Theatre of the light opera "The Student Prince" on Thursday, Friday and Saturday, March 14, 15, and 16. There will also be a matinée on the Saturday. The Hon. Ticket Secretary is Mr. H. R. Board, L.M.S.R., Labour and Establishment Office, Euston.

Two Railway Accidents.—Two railway accidents have been the subject of Ministry of Transport inquiry during the past week. On Wednesday, March 6, Colonel Trench was investigating the cause of a passenger train running into a landslip on February 21 on the Wirksworth single line branch at Driffield, L.M.S.R., when the driver was killed. On Thursday, March 7, Colonel Mount was holding an inquiry into the derailment, on February 25, of a passenger train at Evesham, on the same system. In that case also the driver was killed, and the coroner's inquest therein stands adjourned until April 12.

L.N.E.R. Musical Society's Dance.—Members and supporters of the L.N.E.R. Musical Society attended in full force the final dance of the season held by the Society in Hamilton Hall, Liverpool Street Hotel, on Friday, March 1. The occasion was marked by a presentation of two gold wrist watches to Mr. and Mrs. David King, subscribed to by members and supporters of the dances. In making the presentation, Mr. G. F. Thurston, Divisional General Manager, said Mr. David King had carried out the duties of M.C. at the Society's dances for many years, and this was the last occasion on which he would be acting in an official capacity, as he would be shortly retiring from the company's service. Mr. Percy Syder, London City Manager and Chairman of the Dance Committee, added his tribute. He stated he had been associated with Mr. King as joint M.C. for 15 years and they had M.Cd. over 50 dances together. Among those present were :—

Mr. G. F. Thurston, Dr. MacMahon, Dr. Meta Mackenzie, Messrs. W. R. Mole, F. Downes, Percy Syder, C. Carslake, Chas. Hills, Glaze, Headley, J. Gosling, E. Warren, Jenkins, Armour, C. Johnson, Griffiths, Morkill, Moody, P. Plowman, C. Plowman, and Arthur Vale.

Streamlined Trains in Poland—It is understood that the Polish State Railways are about to order a number of new trains, each comprising a streamlined steam locomotive and two to four all-steel streamlined carriages. They will have a maximum speed of 75 m.p.h., and will be able to maintain an overall average of 60 m.p.h. The tare weight of a locomotive and a four-car train is expected to be about 240 tons, compared with the 500—520 tons of one of the present express locomotives and an eight-car Pullman train.

Agreed Charges.—Thirteen more applications for the approval of agreed charges under the provisions of Section 37 of the Road and Rail Traffic Act, 1933, have been lodged with the Railway Rates Tribunal, as will be seen from the legal notice published on page 475. These applications may be inspected at the office of the Tribunal, 2, Clement's Inn, Strand, W.C.2, at the Railway Clearing House, London, and at 11 named centres outside London. A copy of each application (1s. post free) may be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, 35, Parliament Street.

Improvements at Hull Station.—The L.N.E.R. is about to carry out alterations and improvements at Paragon station, Hull, including the provision of a new tea room on the site of the existing left luggage office at the North end of the station nearest to Collier Street; the conversion of the present tea room and the third class refreshment room in the circulating area into a ladies' waiting room and tea room respectively; and the rearrangement of the left luggage and parcels offices. The new tea room near Collier Street will be conveniently situated, for passengers travelling by rail, and also for persons using the new municipal omnibus station now being built by the Hull Corporation.

L.M.S.R. Royal Signals Dinner and Concert.—The annual dinner and concert of the L.M.S. No. 2 Company, Lines of Communications, Signals (Supplementary Reserve), was held at the Waldorf Restaurant, Manchester, on February 23, under the chairmanship of the commanding officer, Major R. Tandy. Over 100 officers, N.C.O.'s and men from all parts of the L.M.S. system were present. The toast of "The Guests" was proposed by Capt. Mitchell, and replied to by Col. F. R. Coll, M.C., the Chief Signal Officer of the Western Command, who congratulated the company on the excellent reports he has

received from the inspecting officers at last year's camp; he also referred to the specialised railway work of the unit and the necessity for it to maintain its present high standard of efficiency. Capt. Campbell proposed the toast of "The Corps," and in reply, Major Tandy thanked Col. Coll for coming to the dinner and hoped he would be able to visit camp this year. Major Tandy added that he had received a letter from Sir Harold Hartley congratulating the whole company on its very good report, and also that Sir Harold had kindly presented a silver challenge cup to be shot for at this year's camp, between the L.M.S. Workshop Company and his company. Annual camp this year will take place at Longmoor from August 7 to 23.

The Public Relations Department, L.P.T.B.—The London Passenger Transport Board has appointed Mr. Edward Rawdon Smith as Public Relations Officer to the board, in charge of a newly-established Public Relations Department, the work of which is referred to editorially on page 421. Mr. Rawdon Smith was, until his present appointment, Assistant Secretary to the board. Mr. H. S. Chapman has been appointed Assistant Secretary in his place. Mr. Chapman was formerly Secretary of the Metropolitan Railway; was then engaged on its winding-up following the formation of the L.P.T.B.; and since May last has been Public Information Officer, London Transport.

Swiss Experiments for Uniformity in Train Heating.—Experiments with a view to instituting a uniform international system of train heating throughout Europe are being carried on at La Chaux-des-Fonds in the Juras, where a train made up of Swiss, Dutch, Belgian, French and Italian coaches is undergoing tests. La Chaux-des-Fonds was selected for these tests as being the coldest town in Central Europe easily accessible. On the day the train began its trials, the temperature suddenly rose ten degrees.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 9th Week			Totals to Date		
	1935	1934	Inc.or Dec.	1935	1934	Inc. or Dec.
L.M.S.R. (6,926¼ mls.)	£	£	£	£	£	£
Passenger-train traffic...	382,000	376,000	+ 6,000	3,282,000	3,236,000	+ 46,000
Merchandise, &c. ...	437,000	456,000	− 19,000	3,900,000	3,961,000	− 61,000
Coal and coke ...	263,000	276,000	− 13,000	2,418,000	2,463,000	− 45,000
Goods-train traffic ...	700,000	732,000	− 32,000	6,318,000	6,424,000	− 106,000
Total receipts	1,082,000	1,108,000	− 26,000	9,600,000	9,660,000	− 60,000
L.N.E.R. (6,339 mls.)						
Passenger-train traffic...	257,000	245,000	+ 12,000	2,203,000	2,154,000	+ 49,000
Merchandise, &c. ...	310,000	321,000	− 10,000	2,737,000	2,821,000	− 84,000
Coal and coke ...	222,000	242,000	− 20,000	2,187,000	2,265,000	− 78,000
Goods-train traffic ...	532,000	563,000	− 31,000	4,924,000	5,086,000	− 162,000
Total receipts	789,000	808,000	− 19,000	7,127,000	7,240,000	− 113,000
G.W.R. (3,749½ mls.)						
Passenger-train traffic...	158,000	159,000	− 1,000	1,396,000	1,368,000	+ 28,000
Merchandise, &c. ...	175,000	181,000	− 6,000	1,581,000	1,563,000	+ 18,000
Coal and coke ...	101,000	113,000	− 12,000	955,000	1,010,000	− 55,000
Goods-train traffic ...	276,000	294,000	− 18,000	2,536,000	2,573,000	− 37,000
Total receipts	434,000	453,000	− 19,000	3,932,000	3,941,000	− 9,000
S.R. (2,172 mls.)						
Passenger-train traffic...	235,000	228,000	+ 7,000	2,092,000	2,041,000	+ 51,000
Merchandise, &c. ...	64,500	69,000	− 4,500	510,000	555,500	− 45,500
Coal and coke ...	37,500	41,000	− 3,500	321,000	346,500	− 25,500
Goods-train traffic ...	102,000	110,000	− 8,000	831,000	902,000	− 71,000
Total receipts	337,000	338,000	− 1,000	2,923,000	2,943,000	− 20,000
Liverpool Overhead ... (6½ mls.)	1,052	962	+ 90	9,854	9,804	+ 50
Mersey (4½ mls.) ...	3,956	3,982	− 26	37,358	38,133	− 775
*London Passenger Transport Board ...	530,800	512,600	+ 18,200	18,578,200	18,208,500	+ 369,700
IRELAND						
Belfast & C.D. pass. (80 mls.)	1,560	1,575	− 15	15,549	15,771	− 222
,, ,, goods	487	596	− 109	4,158	4,738	− 580
,, ,, total	2,047	2,171	− 124	19,707	20,509	− 802
Great Northern pass. (543 mls.)	9,000	7,600	+ 1,400	70,100	63,850	+ 6,250
,, ,, goods	9,450	9,750	− 300	72,800	73,800	− 1,000
,, ,, total	18,450	17,350	+ 1,100	142,900	137,650	+ 5,250
Great Southern pass. (2,124 mls.)	20,618	19,825	+ 793	167,186	165,908	+ 1,278
,, ,, goods	33,761	33,537	+ 224	333,715	287,722	+ 45,993
,, ,, total	54,379	53,362	+ 1,017	500,901	453,630	+ 47,271

* 35th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes

British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices Mar. 6, 1935	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	66½	48½	47½*	−½
5% Con. Prefce. ...	118	109	115*	−1½
5% Red. Pref. (1950)	115	107	111½*	−1
4% Deb.	117	105	112	−½
4½% Deb.... ...	119	109	115½	−2
4½% Deb.... ...	129½	115¼	124½	−1
5% Deb.	135	126¼	138½	—
2½% Deb.... ...	75	64	80½	−1
5% Rt. Charge ...	134 7/16	123¼	131½	—
5% Cons. Guar. ...	132¾	121¾	127½*	−3
L.M.S.R.				
Ord.	30½	19½	17	—
4% Prefce. (1923)	64¼	41	45½*	−½
4% Prefce. ...	87	69½	75½*	−1½
5% Red. Pref. (1955)	107	92½	101½	—
4% Deb.	114 1/8	100½	104	—
5% Red. Deb. (1952)	118 11/16	111¼	117½	—
4% Guar.	106½	96¾	98*	−½
L.N.E.R.				
5% Pref. Ord. ...	24¾	13½	10½	−¾
Def. Ord.	11½	6 7/8	5¾	—
4% First Prefce. ...	76	59½	64½	−1½
4% Second Prefce.	47	25½	22½	−½
5% Red. Pref. (1955)	94½	80	85½	−1
4% First Guar. ...	104	92	95½	−1
4% Second Guar.	97 7/8	86½	87½	−2
3% Deb.	90	74½	78½	−1
4% Deb.	114	99¼	102	−½
5% Red. Deb. (1947)	117	108	115½	—
4½% Sinking Fund Red. Deb.	111¼	105¼	110½	—
SOUTHERN				
Pref. Ord.... ...	90	63 1/8	78*	—
Def. Ord.	32 5/8	19	20	—
5% Prefce. ...	118 3/16	107½	115*	−1½
5% Red. Pref. (1964)	115¾	107½	114½*	—
5% Guar. Prefce.	132	120¾	128½*	−1
5% Red. Guar. Pref. (1957)	119½	113	117½*	—
4% Deb.	116½	103¼	111	−½
5% Deb.	134	124 15/16	134½	−2
4% Red. Deb. 1962–67	113 11/16	105 9/16	111½	−1
BELFAST & C.D.				
Ord.	6	5	5¼	—
FORTH BRIDGE				
4% Deb.	110	100	109½	—
4% Guar.	110	100	109½	—
G. NORTHERN (IRELAND)				
Ord.	9¾	4 15/16	10	—
G. SOUTHERN (IRELAND)				
Ord.	25	12½	26	+1½
Prefce.	21½	13 15/16	26	−1¾
Guar.	48	39	56	−3¼
Deb.	67	59	74	−1
L.P.T.B.				
4½% "A" ...	126	115	121½	−1
5% "A"	135½	124½	132	—
4½% "T.F.A." ...	113½	107½	112	—
5% "B"	131¾	118	124½	—
"C"	97	73	97*	+4
MERSEY				
Ord.	15¼	7	14	—
4% Perp. Deb. ...	93½	82½	94½	—
3% Perp. Deb. ...	66½	61½	69½	—
3% Perp. Prefce....	54	44½	52½	—

* ex dividend

CONTRACTS AND TENDERS

D. Wickham & Co. Ltd. has received an order from the L.N.E.R. for three petrol-driven motor permanent-way gang trolleys and trailers.

D. Wickham & Co. Ltd. has also received orders from the Central Argentine Railway for 57 petrol-driven gang trolleys, three petrol-driven mechanic's rail trolleys, and 228 roller-bearing axleboxes.

Wagons for Egypt

In addition to the order placed by the Egyptian State Railways Administration with Metropolitan-Cammell Carriage & Wagon Co. Ltd. for 250 10-ton all-steel box trucks, as recorded in this column in our issue of February 15, the Administration has now placed further orders for wagons as follow :—

Metropolitan-Cammell Carriage & Wagon Co. Ltd: 54 10-ton animal trucks, at total price stated to be LE. 15,552, delivery c.i.f. Alexandria in 17 weeks.

La Brugeoise et Nicais et Delcuve, La Louviere: 85 10-ton composite steel and wood-bodied perishables vans, to be fitted with vacuum brake gear, at total price of LE. 26,860, delivery c.i.f. Alexandria in 22 weeks.

The total price of the above-mentioned 250 10-ton all-steel box trucks was LE. 51,029, for delivery c.i.f. Alexandria in 21 weeks.

Stewarts and Lloyds Limited has received an order from the Egyptian State Railways Administration for mild steel galvanised pipes and fittings at a total price of £1,011 4s. 6d. delivered f.o.b. Liverpool. (Ref. E.S.R. 317G3/3.)

Siemens Bros. & Co. Ltd. has received an order from the Egyptian State Railways Administration for battery materials at a total price of £498 12s. 6d. (Ref. E.S.R. 34.334.)

The General Electric Co. Ltd. has received an order from the Egyptian State Railways Administration for battery materials at a total price of £325. (Ref. E.S.R. 34.339, item 1.)

J. Baker & Bessemer Limited has received an order for 191 steel locomotive tyres from the Central Argentine Railway.

J. Baker & Bessemer Limited has also received an order for 10 pairs of wheels and axles for fruit cars and four spare axles from the Santa Marta Railway.

Harland & Wolff Limited has received an order from the L.M.S.R. (Northern Counties Committee) for a 325-b.h.p. diesel locomotive, which is to be fitted with Voith–Sinclair hydraulic transmission as made by the Hydraulic Coupling & Engineering Co. Ltd.

The Hydraulic Coupling & Engineering Co. Ltd. has received an order for a ring-valve traction type hydraulic coupling and a traction-type gear box to be fitted to a diesel shunting locomotive in Holland, which is to be driven by a Gardner–Kromhout engine of 104 b.h.p.

Jones, Burton & Co. Ltd. has received orders for one traversing-head shaping machine and one portable hydraulic wheel press from the Peruvian Corporation.

Electro Mechanics Limited has received an order from the Indian Stores Department for eight vertical cross-tube, 125-lb. pressure boilers at a total cost of Rs. 34,256.

Marshall, Sons & Co. (India) Ltd. has received an order from the Indian Stores Department for seven vertical cross-tube, 125-lb. pressure boilers at a total price of Rs. 31,850.

Suren Piras & Company has received orders from the Indian Stores Department for 88 locomotive axles at a total price of Rs. 59,866 and 44 locomotive tyres at a total price of Rs. 3,136.

J. Stone & Co. (India) Ltd. has received orders from the Indian Stores Department for 174 broad gauge and 10 narrow gauge inter-vehicle couplers at a total price of Rs. 12,328.

Electric Locomotives for S. Africa

The Metropolitan-Vickers Electrical Co. Ltd. has in hand for quick delivery an order for five double-bogie 1,200-h.p. electric locomotives for the Natal section of the South African Government Railways. These locomotives are almost duplicates with the 95 Metrovick locomotives which have been at work in Natal since 1929.

The South Indian Railway Administration has placed the following orders for materials to be supplied to the inspection of the consulting engineers, Messrs. Robert White & Partners :— P. & W. MacLellan Limited : 20 tons bolts, nuts, and rivets ; Edward & William Lucas Limited : 3,400 shovels ; and Stedman, Crowther & Company : 80 tons copper ingots.

Brown Bayley's Steel Works Limited has received an order for 245 steel carriage and wagon tyres from the Central Argentine Railway.

The Birmingham Railway Carriage & Wagon Co. Ltd. has received an order from the Crown Agents for the Colonies for four six-ton bogie goods brake vans, for the 3 ft. 6 in. gauge lines of the Gold Coast Government Railway.

Boiler Enquiries

The Agent, North Western Railway of India, Lahore, invites tenders, on a rupee basis, receivable by April 15, for the supply of three HP/S (4-6-0), 18 HG/S (2-8-0), and one N (2-10-0) class locomotive boilers. Drawings may be seen at the offices of Hodges, Bennett & Co. Ltd., 16, Victoria Street, Westminster, S.W.1.

The North Western Railway of India, Lahore, invites tenders, receivable by March 27, for the supply of about 290,000 rail anchors, to be delivered between May 1 and August 31.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), New Delhi, invites tenders, receivable by March 25, for quantities of indiarubber bearing, buffer, bolster, and drawbar springs required for the G.I.P. and E.I. Railways.

The Viação Ferrea do Rio Grande do Sul Administration is calling for tenders, to be presented in Brazil by March 28, for the supply of 136 axles (rough) for engines, carriages, and wagons. Firms desirous of offering axles of United Kingdom manufacture can obtain further details from the Department of Overseas Trade.

Electric Locomotive Enquiry

The South African Government Railways have issued inquiries for the supply of 23 electric locomotives for use on the 3,000-volt d.c. extension now being made from Glencoe to Volksrust and from Cato Ridge to Durban. Tenders are due in Johannesburg at the end of this month.

The Chinese Government Purchasing Commission invites tenders from British manufacturers for the following equipment : locomotive weighing machines, locomotive wheel-drop pit jack, portable locomotive axle bearing press, oxy-acetylene welding plant, motor driven grindstone, double-ended grinding machine, high-speed cold sawing machine, duplex steam gauges and deadweight, hydrostatic level 50-kW steam power plant, portable fire pump, flexible suction hose, hydraulic boiler proving pump, 10-cwt. electric arc furnace, and light rails and platform wagons.

Forthcoming Events

Mar. 8 (*Fri.*).—Institute of Transport (Newcastle), at Royal Station Hotel, 7.30 p.m. "The Industrial Transport Manager and Distribution," by Mr. J. W. Porter.

Mar. 9 (*Sat.*).—Scientific Society of the Royal Technical College, George Street, Glasgow, 7.30 p.m. "Railway Signalling Systems," by Mr. W. Bryson.

Mar. 11 (*Mon.*).—Permanent Way Institution (London), at Albert Stanley Inst., Hammersmith Station, 7 p.m. "Maintenance Problems Appertaining to Permanent Way on the London Passenger Transport Board Railways," by Mr. H. Windmill.

Retired Railway Officers' Society, at Abercorn Rooms, Liverpool Street, London, E.C.2, 12.45 for 1 p.m. Annual Luncheon.

Mar. 12 (*Tues.*).—L.N.E.R. (Middlesbrough) Lecture and Debating Society, at Cleveland Scientific and Technical Inst., Corporation Road, 7.15 p.m. Annual General Meeting and Reading of Prize Essay.

L.N.E.R. (Newcastle-Sunderland) Lecture and Debating Society, at Newcastle, 7 p.m. Annual Meeting and Prize Essay.

Permanent Way Institution (Sheffield), at Royal Victoria Hotel, 7 p.m. Dinner.

Mar. 13 (*Wed.*).—Institution of Railway Signal Engineers, at Inst. of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. "Nomenclature of Interlocking Signals," by Mr. F. B. Egginton.

Institution of Welding Engineers (London), at Inst. of Marine Engineers, The Minories, E.C.3, 7.45 p.m. "Recent Developments regarding Arc Welded Joints and the Effects of Fatigue," by Mr. O. Bondy.

L.N.E.R. (Darlington) Lecture and Debating Society, at North Road Inst., 7.20 p.m. Annual General Meeting.

Mar. 14 (*Thurs.*).—Institution of Electrical Engineers. Savoy Place, London, W.C.2, 6 p.m. "The Engineer Administrator," by Mr. E. S Byng.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 7 p.m. Annual Meeting and Prize Essays.

S.R. (London) Lecture and Debating Society, at Chapter House, St. Thomas' Street, London Bridge, S.E.1, 5.45 p.m. "Early Railway Bridges," by Mr. C. Gribble.

Mar. 15 (*Fri.*).—Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "An Introduction to Railway Heraldry," by Mr. G. W. J. Potter.

LEGAL AND OFFICIAL NOTICES

In the Court of the Railway Rates Tribunal.

Road and Rail Traffic Act, 1933. Agreed Charges.

NOTICE IS HEREBY GIVEN that applications for the approval of Agreed Charges under the provisions of Section 37 of the Road and Rail Traffic Act, 1933, short particulars of which are set out in the Schedule hereto, have been lodged with the Railway Rates Tribunal.

The said applications may be inspected at the Office of the Tribunal, 2, Clement's Inn, Strand, London, W.C.2, at any time during office hours and at the following places :—

LONDON : Railway Clearing House, 123, Seymour Street, N.W.1.

BIRMINGHAM : District Goods Manager's Office, Snow Hill, Great Western Railway.

CARDIFF : Divisional Superintendent's Office, Great Western Railway.

EXETER : Western Divisional Superintendent's Office, Southern Railway.

LEEDS : District Goods Manager's Office, Wellington Street, London & North Eastern Railway.

LEICESTER : District Goods and Passenger Manager's Office, London Midland & Scottish Railway.

MANCHESTER : District Goods Manager's Office, Hunt's Bank, London Midland & Scottish Railway.

SOUTHAMPTON : Southern Divisional Superintendent's Office, Southampton West, Southern Railway.

YORK : Goods Manager's Office, London & North Eastern Railway.

ABERDEEN : District Goods and Passenger Manager's Office, London Midland & Scottish Railway.

EDINBURGH : District Goods and Passenger Manager's Office, Waverley Station, London & North Eastern Railway.

GLASGOW : Commercial Manager's Office, Central Station, London Midland & Scottish Railway.

A copy of each Application lodged with the Tribunal can be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, 35, Parliament Street, Westminster, London, S.W.1, price 1s., post free.

Notices of objection by any parties entitled to object to the approval of any of the said Agreed Charges must state concisely the grounds of objection and must be filed at the office of the Registrar, 2, Clement's Inn, Strand, London, W.C.2, on or before the 26th day of March, 1935, and a copy thereof on or before the same day served on or sent by registered post to Mr. G. Cole Deacon, at the above address. A separate Notice must be filed and served in respect of each Application.

Each Notice filed must be on foolscap size paper and must be stamped with an adhesive fee stamp for 2s. 6d. (which can be purchased at the office of the Tribunal only). If sent by post for filing each Notice must be accompanied by a Postal Order for 2s. 6d. payable to the Registrar when a stamp will be affixed at the office. A Notice by a Representative Body of Traders must contain a statement of the facts upon which such Body claims to represent a substantial number of traders interested in, or likely to be affected by the decision on, the application.

Four additional copies of each Notice must be lodged with the original at the office of the Registrar.

T. J. D. ATKINSON,
Registrar.

1st March, 1935.

Number of Application and Date of Lodgment	Parties to Agreement	Nature of Agreed Charge
1935, No. 77—Feb. 15, 1935	I. & R. MORLEY LIMITED, 18, Wood Street, London, E.C.2, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package. Gloves, Hosiery and Textiles.
1935, No. 79—Mar. 1, 1935	BLEASDALE & SONS, 26, Penny Street, Lancaster, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos. and L.P.T.B. This application by leave granted under Rule 4, relates also to Agreed Charges with other Registered Bacon Curers in Great Britain as specified therein.	Per Pig. Live Pigs consigned to Registered Bacon Curers or their Agents.
1935, No. 80—Mar. 1, 1935	ALLIED SUPPLIERS LIMITED, 179/189, City Road, London, E.C.1, and the G.W. Railway Co.	Per ton. Multiple Shop Traffic (Provisions, &c.).
1935, No. 81—Mar. 1, 1935	THOMAS HEDLEY & CO. LTD., Phœnix Buildings, Collingwood Street, Newcastle-on-Tyne, and the L. & N.E. Railway Co.	Per ton. Candles, Soap and Soap with articles for advertisement.
1935, No. 82—Mar. 1, 1935	W. W. OSGERBY LIMITED, Hedon Road, Hull, and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Bath Salts, Cleansing Powder, Dry Soap and Lavatory Cleanser.
1935, No. 83—Mar. 1, 1935	A. SANDERSON & CO., LTD., Kingston Colour Paint and Varnish Works, Hull, and the L. & N.E. and L.M. & S. Railway Cos.	Per ton. Creosote, Earth Colours, Glue, Linseed Oil, Lead (Red and White), Pitch, Plaster, Pumice, Putty, Whiting, in consignments not exceeding 2 tons each in weight : Dry Colours, Distempers, Dryers, Paints, *Thinners, *Turpentine, *Varnishes, Advertising Material, new empty tins. * Not applicable to consignments forwarded in Tank Wagons.
1935, No. 84—Mar. 1, 1935	STEPS AND TABLES LIMITED, Melbourne Street, Gloucester, and the G.W. and L.M. & S. Railway Cos.	Per ton. Chairs, Joiner's Work, Ladders and Tables.
1935, No. 85—Mar. 1, 1935	WAKELEY BROS. & CO. LTD., Honduras Wharf, Bankside, London, E.C.1, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. (i) Agricultural and Garden Seeds and Bulbs, Garden Ornaments, and Horticultural Requisites. (ii) Agricultural Drain-pipes, Cement, Soil, Manure, and Sand, packed, in consignments not exceeding 2 tons each in weight.
1935, No. 86—Mar. 1, 1935	BRITISH BELTING & ASBESTOS LIMITED, 59, Southwark Street, London, S.E.1, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per package. Asbestos Goods, Belting (Cotton, Leather and Rubber), Packing for Machinery, Small Hand Cutting and Drilling Machines, Rivets and Advertising Matter, in packages under 2 cwt. each in weight.
1935, No. 87—Mar. 1, 1935	CO-OPERATIVE WHOLESALE SOCIETY LIMITED, 1, Balloon Street, Manchester, and the L. & N.E. and L.M. & S. Railway Cos.	Per package. Hosiery.
1935, No. 88—Mar. 1, 1935	HARRIS & CO. (CONFECTIONERS) LTD., Bryanston House, Lomond Grove, London, S.E.5, and the G.W., L. & N.E., L.M. & S. and Southern Railway Cos.	Per ton. Biscuits, Cake, Dried Fruits and Shelled Nuts (used in connection with the business of a Confectioner), Margarine and similar compounds, Marzipan, Fondant Sugar, Baking Powder, Block Chocolate, Cocoa and Jam in tins.
1935, No. 89—Mar. 1, 1935	THE KETTERING CLOTHING MANUFACTURING CO-OPERATIVE SOCIETY LIMITED, Dryden Street, Kettering, and the L.M. & S. Railway Co.	Per package. Clothing.
1935, No. 90—Mar. 1, 1935	FRANK MANN LIMITED, Riverside Works, Shipley, and the L. & N.E. and L.M. & S. Railway Cos. *Applicable also to traffic consigned by :—* F. BUTLER, THE MIDLAND CONFECTIONERY COMPANY.	Per package. Confectionery, Clothing, Drapery and General Stores Wares.

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33, Tothill Street, London, S.W.1.

OFFICIAL ADVERTISEMENTS

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

Forthcoming Meetings

Mar. 8 (*Fri.*).—**London & North Eastern Railway** (Ordinary General), Hotel Great Central, Marylebone, N.W.1, at 2 p.m.

Mar. 26 (*Tues.*).—**Ottoman Railway from Smyrna to Aidin** (Half-yearly Ordinary General), Winchester House, Old Broad Street, E.C. 2, at 11 a.m.

Mar. 26 (*Tues.*).—**Temiscouata Railway** (Annual General), Chateau Frontenac, Quebec, at 12 noon.

Mar. 27 (*Wed.*)—**Grand Union Canal Company** (Ordinary General), 5, Lloyd's Avenue, Fenchurch Street, E.C., at 12 noon.

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Railway Share Market

Notwithstanding the general weakness which was shown in the stock and share markets this week on the uncertain movements of sterling and the delay in the Anglo-German conversations, it was noticeable that on balance home railway stocks have held up remarkably well. Some of the prior lien stocks came back in accord with the downward movement in gilt-edged stocks, but the tendency of the junior stocks of the four big home railway groups was encouraging.

It is believed that the public has been buying these stocks more freely with a view to locking up for capital appreciation. Sales of stock by one or two big holders were absorbed with unexpected ease. The stocks which are being favoured are Southern preferred and deferred, L.M.S. 1923 preference and ordinary, L.N.E. second preference and Great Western ordinary. Southern deferred is being particularly bought on the view expressed by the Chairman at last week's meeting that the company is slowly getting back to the position where it was able in 1929 to pay a dividend of 2½ per cent. on the deferred stock. It is being pointed out that when this stock was in receipt of only 2 per cent. for 1928 it stood at about double the present price, and that a dividend of 2½ per cent. would mean a yield of 12½ per cent. at the current price. A more general favourable influence on the market has been the success of the Southern in connection with its rating assessment, and the prospect of the other companies obtaining similar redress which may mean substantial repayments. In foreign railway stocks the trend has again been adverse to holders. Brazilian stocks have shown weakness and San Paulo ordinary is now down to 65—69.

Argentine railway stocks failed to benefit from advices of a coming big maize crop, and although Central Argentine 4½ per cent. preference stock was very active at between 37½ and 38 it was unable to maintain the level later in the week. Mexican 6 per cent. debenture stock again reacted to the low record of 16—20. Indian railway stocks were marked down, but this movement was solely to bring them into accord with the lower levels of gilt-edged stocks.

Glyn, Mills & Company the trustees and registrars under the Trust Deed relating to the Metropolitan assented stock constituted by the London Passenger Transport Act, 1933, announce that out of the forthcoming instalment of interest on the London Transport "C" stock held by them under the trust deed a distribution of 1 per cent. will be made on the Assented stock on account of the interest for the year ending June 30, 1935.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1934-35	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1934	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1934	Prices: Lowest 1934	Prices: Mar. 6, 1935	Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	830	3.3.35	16,910	+ 10	9	112,820	111,900	+ 920	Ord. Stk.	26⅝	19	18	Nil
	Argentine North Eastern	753	2.3.35	6,838	— 243	35	253,422	295,997	— 42,575	,,	11	6⅞	7	Nil
	Argentine Transandine	111	—	—	—	—	—	—	—	A. Deb.	52	45	50	8
	Bolivar	174	Feb., 1935	6,600	+ 200	8	12,450	12,950	— 500	6 p.c. Deb. Bonds.	10	6½	10	Nil
	Brazil	—	—	—	—	—	—	—	—		135¼	107/16	13	3⅛
	Buenos Ayres & Pacific	2,806	2.3.35	98,050	+ 3,642	35	2,540,407	2,921,108	— 380,701	Ord. Stk.	16½	8½	8	Nil
	Buenos Ayres Central	190	17.2.35	$97,000	+ $25,100	33	$3,730,300	$3,721,300	+ $9,000	Mt. Deb.	23	10	21½	Nil
	Buenos Ayres Gt. Southern	5,085	2.3.35	209,811	+ 36,533	35	4,898,467	5,640,116	— 741,649	Ord. Stk.	35	22	25	Nil
	Buenos Ayres Western	1,930	2.3.35	53,191	+ 631	35	1,521,726	1,829,139	— 307,413	,,	27½	18½	21	Nil
	Central Argentine	3,700	2.3.35	118,425	+ 6,553	35	4,129,347	4,717,469	— 588,122	,,	23	13½	16	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	14	7	8½	Nil
	Cent. Uruguay of M. Video	273	23.2.35	19,395	+ 1,092	34	573,223	555,522	+ 17,701	Ord. Stk.	15½	8	8½	Nil
	Do. Eastern Extn.	311	23.2.35	4,067	+ 68	34	121,558	109,484	+ 12,074	—	—	—	—	—
	Do. Northern Extn.	185	23.2.35	2,634	+ 476	34	65,754	59,712	+ 6,042	—	—	—	—	—
	Do. Western Extn.	211	23.2.35	1,741	— 426	34	52,435	55,202	— 2,767	—	—	—	—	—
	Cordoba Central	1,218	2.3.35	23,700	+ 2,160	35	1,011,390	1,227,970	— 216,580	Ord. Inc.	6	3	3½	Nil
	Costa Rica	188	Dec., 1934	18,046	+ 2,804	26	99,051	114,966	— 15,915	Stk.	30⅝	23½	31½	6⅜
	Dorada	70	Jan., 1935	10,500	— 1,200	4	10,500	11,700	— 1,200	1 Mt. Db.	103	95	102½	5⅞
	Entre Rios	810	2.3.35	12,387	+ 2,205	35	442,064	456,866	— 14,802	Ord. Stk.	21½	12	14½	Nil
	Great Western of Brazil	1,082	2.3.35	10,400	+ 700	9	100,400	97,400	+ 3,000	Ord. Sh.	7/8	5/8	1/2	Nil
	International of Cl. Amer.	794	Jan., 1935	$429,477	— $31,256	4	$429,477	$460,733	— $31,256	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	1/-	1/-	1/2	Nil
	La Guaira & Caracas	22⅝	Feb., 1935	3,400	+ 220	8	6,500	7,580	— 1,080	Stk.	12⅝	7⅝	8½	Nil
	Leopoldina	1,918	2.3.35	23,660	— 4,156	9	203,276	198,744	+ 4,532	Ord. Stk.	14⅝	7	7½	Nil
	Mexican	483	28.2.35	$206,700	— $29,200	8	$1,973,900	$1,767,500	+ $206,400	,,	3¼	1½	1½	Nil
	Midland of Uruguay	319	Jan., 1935	13,282	+ 1,832	30	79,115	68,680	+ 10,435	,,	1½	1/2	1½	Nil
	Nitrate	401	28.2.35	7,172	— 3,697	8	26,345	52,992	— 26,647	Ord. Sh.	32/32	5/-	2⅜	Nil
	Paraguay Central	274	2.3.35	5,780	+ 2,630	35	169,380	112,000	+ 57,380	Pr. Li. Stk.	84	67	76½	7 13/16
	Peruvian Corporation	1,059	Feb., 1935	62,821	+ 11,289	34	499,646	439,952	+ 59,694	Pref.	14½	8	8	Nil
	Salvador	100	23.2.25	¢45,250	+ ¢5,450	34	¢622,402	¢623,383	— ¢981	Pr. Li. Db.	75	70	70§	7⅛
	San Paulo	153½	24.2.35	35,083	— 582	8	252,567	238,367	+ 14,200	Ord. Stk.	86	67	66	6 1/16
	Taltal	164	Jan., 1935	3,100	— 23	30	16,670	15,592	+ 1,087	Ord. Sh.	2⅛	1 7/16	1¾	5 11/16
	United of Havana	1,365	2.3.35	55,080	+ 21,488	35	722,065	521,092	+ 200,973	Ord. Stk.	6	2	3½	Nil
	Uruguay Northern	73	Jan., 1935	1,152	+ 230	30	8,446	8,305	+ 141	Deb. Stk.	6¼	3	4½	Nil
Canada.	Canadian National	23,735	28.2.35	655,122	+ 7,470	8	4,906,823	4,617,558	+ 289,265	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78¼	51½	70½	5 11/16
	Grand Trunk	—	—	—	—	—	—	—	— 4 p.c. Gar.		104½	97¼	101½	3 15/16
	Canadian Pacific	17,211	28.2.35	429,600	— 5,800	8	3,384,600	3,508,200	— 123,600	Ord. Stk.	18 5/16	11 1/16	11	Nil
India.†	Assam Bengal	1,329	26.1.35	30,367	+ 1,888	43	1,165,346	1,014,258	+ 151,088	Ord. Stk.	88½	72	84½	3 9/16
	Barsi Light	202	9.2.35	1,702	— 601	45	119,827	129,435	— 9,608	Ord. Sh.	104½	98⅝	104½	5⅝
	Bengal & North Western	2,113	16.2.35	57,942	+ 8,064	20	1,002,246	912,377	+ 89,869	Ord. Stk.	297½	262	293½	5 9/16
	Bengal Dooars & Extension	161	9.2.35	2,539	— 200	45	135,261	133,946	+ 1,315	,,	125¼	124	126½	5⅛
	Bengal-Nagpur	3,269	2.2.35	139,350	+ 19,727	44	4,935,414	4,568,030	+ 367,384	,,	105½	96	104½	3 15/16
	Bombay, Baroda & Cl. India	3,072	23.2.35	179,250	— 21,000	47	7,412,625	7,105,200	+ 307,425	,,	115	108½	114½	5¼
	Madras & South'n Mahratta	3,230	2.2.35	107,700	— 6,646	44	4,661,581	4,725,827	— 64,246	,,	131	122⅝	127½	7 7/16
	Rohilkund & Kumaon	572	16.2.35	12,548	— 482	20	198,816	189,178	+ 9,638	,,	263	250	283½	5⅝
	South India	2,526	16.2.35	78,039	+ 416	46	3,641,123	3,546,740	+ 94,383	,,	119	115	116	6⅞
Various.	Beira-Umtali	204	Dec., 1934	55,495	+ 6,077	13	180,985	149,024	+ 31,961	—	—	—	—	—
	Bilbao River & Cantabrian	15	Feb., 1935	2,061	+ 365	8	4,310	3,243	+ 1,067	—	—	—	—	—
	Egyptian Delta	621	20.2.35	6,597	— 48	46	216,962	213,077	+ 3,885	Prf. Sh.	21 3/16	1¾	1⅞	5⅝
	Great Southern of Spain	104	28.2.35	1,615	— 314	8	15,741	16,789	— 1,048	Inc. Deb.	4	3½	3½	Nil
	Kenya & Uganda	1,625	Jan., 1935	239,686	+ 47,245	4	239,686	192,441	+ 47,245	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50	33	45½	7 11/16
	Mashonaland	913	Dec., 1934	109,744	+ 19,028	13	342,255	277,053	+ 65,202	1 Mg. Db.	101	91¾	103	4⅞
	Midland of W. Australia	277	Dec., 1934	14,518	— 767	26	85,947	80,396	+ 5,551	Inc. Deb.	100	93	96½	5 5/16
	Nigerian	1,905	12.1.35	58,964	— 7,308	41	1,508,338	1,325,798	+ 182,540	—	—	—	—	—
	Rhodesia	1,538	Dec., 1934	181,616	+ 32,520	13	556,652	465,394	+ 91,258	4 p.c. Db.	104⅞	97½	105	3 15/16
	South African	13,217	9.2.35	540,560	+ 77,499	45	23,246,765	20,479,160	+ 2,767,605	—	—	—	—	—
	Victorian	6,172	Oct., 1934	893,146	+ 75,686	17	3,032,823	2,938,131	+ 94,692	—	—	—	—	—
	Zafra & Huelva	112	Jan., 1935	11,383	— 1,526	4	11,383	12,909	— 1,526	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16.

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rate of exchange and not on the par value.

Electric Railway Traction

BRITISH RAILWAY ELECTRIFICATION

Views of Railway Chairmen

Southern Railway

Dealing first with passenger train traffic, you will remember that in 1933 we recorded an increase in our carryings of 7,000,000 passengers as compared with the number carried in 1932. It is very satisfactory to be able to report that in the year under review the number of passengers carried further increased by no less than 13,600,000. The total number of journeys, including those of season ticket holders, was approximately 338,000,000. This creates a record for the company. Our previous highest was 330,000,000 in 1930. Of this increase of 13,600,000 passengers, no less than 11,000,000 were carried on those sections of the line that have been electrified. The total receipts from passengers on the electrified lines advanced by £302,000.—*Extract from Mr. R. Holland-Martin's speech at the annual meeting of the Southern Railway Company.*

[Passenger journeys over the Southern Railway electrified lines to Brighton, Hove, and Worthing increased by over 100,000 in 1934 to a total of more than 2,600,000, compared with 2,500,000 in 1933, and 1,900,000 in 1932, the last pre-electric year.—ED. *R.G.*]

London Midland & Scottish Railway

I must again refer to electric traction in so far as it affects us. We have 117 miles of road, or 282 miles of track, which has been constructed or adapted to electric traction during the past 32 years, at a cost, with equipment, of £11,000,000.

Close consideration has recently been given to further suburban electrification and the general question of main line electrification. Although our inquiries are not complete, there does not appear to be any likelihood of any further large-scale outlay in the immediate future. We have a statutory obligation to show annually to the Railway Rates Tribunal that our affairs have been conducted with efficiency and economy, quite apart from the board's obligation to you in this respect, and any new outlay for electrification or anything else must comply with that test. If any new work is unlikely in due course to pay its way, clearly the burden will fall on railway users generally, or the proprietors or employees, or partly one or another. Such outlay differs from the competitive expenditure on public roads for motor tractions, which causes a charge on the rates, whether the expenditure is commercially justified or not.

Those who talk glibly on the subject without knowledge of the facts may not bother much about this aspect, but we have to do so. The merits and amenities of electricity have to be weighed against the merits of other forms of tractive power, with due regard to the risk involved in new outlay on fixed plant in the present still indefinite position of the finance of the public roads.—*Extract from Sir Josiah Stamp's speech at the annual meeting of the London Midland & Scottish Railway.*

London & North Eastern Railway

A question which has received some prominence during recent months is that of the electrification of our Great Eastern suburban service. Various schemes for electrification had been put forward to the old Great Eastern Railway, but none of them was found satisfactory. The Board have been, and are, fully conscious of the serious overcrowding which exists in the service at rush hours, and immediately after amalgamation addressed themselves to the solution of this problem. They had several fresh schemes for electrification prepared, but the initial and principal difficulty was that the existing lines between Liverpool Street and Stratford were already fully loaded, and were carrying the heaviest suburban service, steam or electric, to be found anywhere in the world. No intensification of the service could be obtained to justify electrification, except by a further widening of the lines between Liverpool Street and Stratford and a re-arrangement of the slow and fast lines by means of a fly-over. These works were estimated to cost £3,000,000, apart altogether from expenditure on electrification proper. Apart from this the traffic to be handled was of a peculiar character—very heavy during the rush hours morning and evening, relatively light at other times.

The total expenditure involved would amount to £7,000,000 and no adequate return could be expected on the outlay. The existence of keen competition by road, and the possibility of competition by tube in other hands, had also to be considered, as such competition would have effectually destroyed any prospect of ultimate fructification of the expenditure. The possibility of a tube scheme was also considered, but here, again, the expenditure involved was heavy and the net return negligible.

The Board came to the conclusion that in the absence of a pool of competing interests and of substantial Government assistance, electrification of the Great Eastern suburban lines could not be other than a losing proposition.

They accordingly turned all their attention to the improvement of the existing steam service, within the limits of what was financially possible to them. The company have done their utmost year by year to improve the rolling stock used on the Great Eastern suburban service. Since amalgamation, 59 new trains have been provided for the suburban services of the Great Eastern section; 11 of these are now working in the Ilford service, 34 in the Enfield and Chingford services, and 14 in the Hertford service. Fifty-one of the new trains are of articulated stock, and all are of modern design. The carriage building programme for 1935 includes the provision of 12 new suburban trains, which will complete the equipment.

During the same period the company has spent £1,000,000 in widening its suburban lines between Romford and Shenfield, a distance of 8½ miles. These works have enabled it to increase the mileage of its Great Eastern suburban services by upwards of 200,000 miles per annum, whilst at the same time it has improved medium distance

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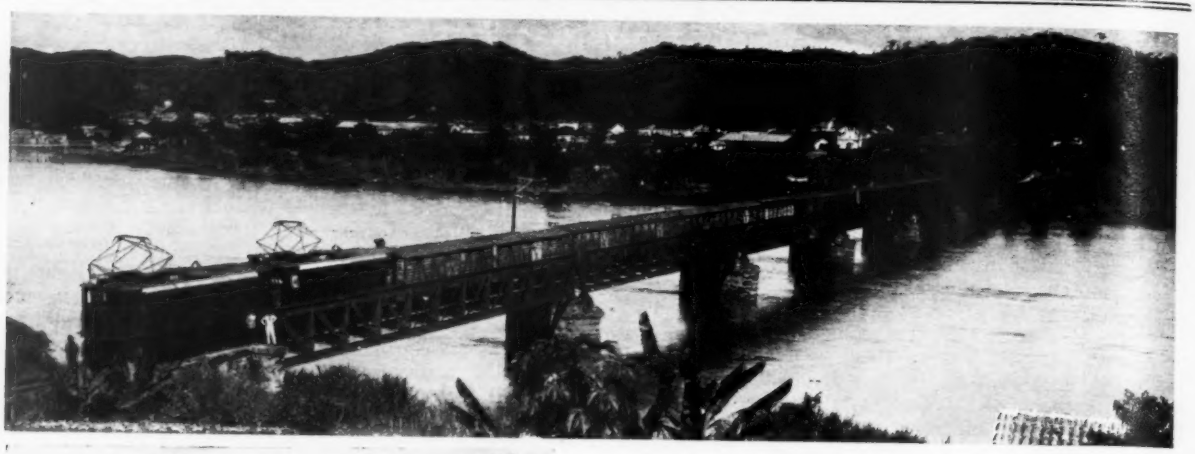
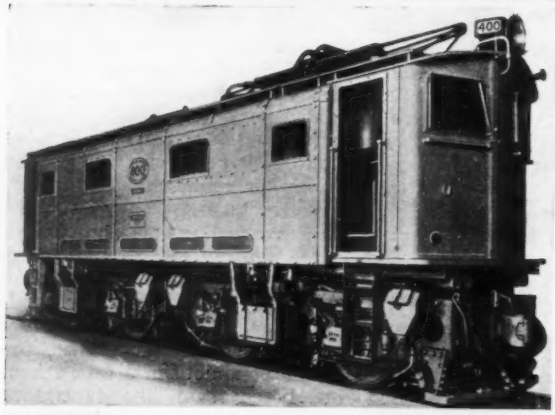
services from places such as Southend and Clacton. There has been an increase of 13 per cent. (almost 600,000 miles per annum) in the mileage of the suburban service since 1922. It is not possible to make further improvements in the speed, capacity, or intensity of the steam service without very heavy expenditure in widening the lines between Liverpool Street and Stratford, and providing fly-over junctions near Ilford.

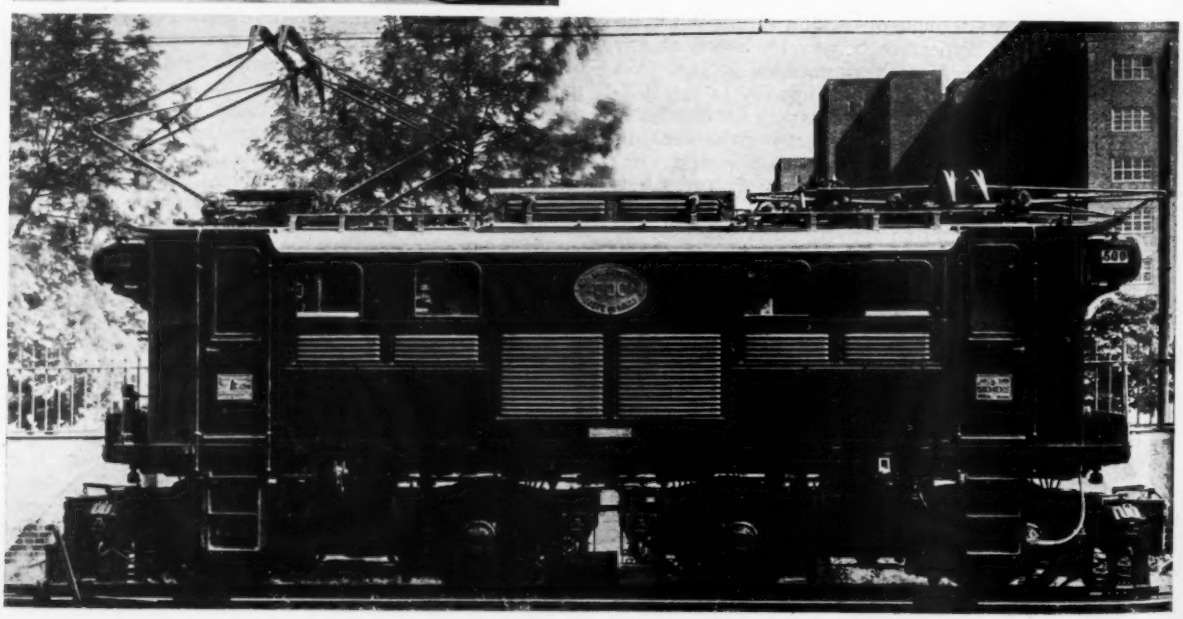
The question of electrification now rests with the Standing Joint Committee representing the London Passenger Transport Board and the four main line companies. All details of the proposal have been submitted to them, and the decision now lies entirely in their hands. In the meantime the London & North Eastern Company will, of course, continue to use every endeavour to carry on the existing service with punctuality and efficiency.—*Extract from Mr. William Whitelaw's review of the London & North Eastern Railway Company's business during* 1934.





OESTE DE MINAS RAILWAY

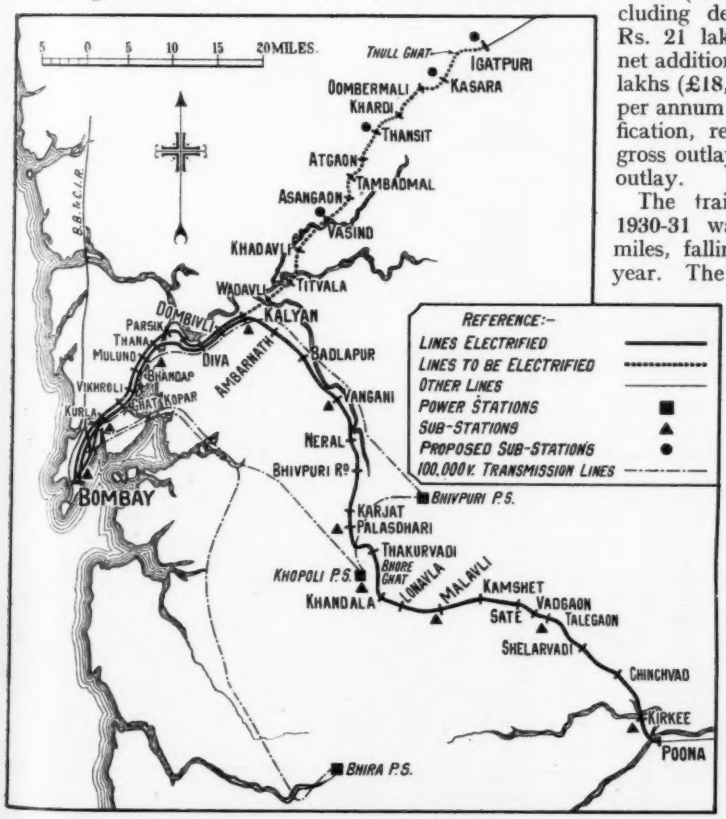
The top illustration shows a double-headed train crossing the river at Barra Mansa, hauled by two Met-Vick locomotives. To the left is shown one of the 600-b.h.p. locomotives built in 1926 by Metropolitan-Vickers when that company carried out the conversion of 45 route miles from Barra Mansa to Pestana. The bottom illustration shows one of the eight 960-h.p. goods locomotives built for the line in 1933 by Siemens-Schuckertwerke A.G.



INDIAN RAILWAY ELECTRIFICATION RESULTS

AFTER long and careful investigation into the financial results of the electrification schemes executed on the Great Indian Peninsula Railway, a sufficiently accurate estimate of the savings resulting from the replacement of steam traction over certain sections is now available. The total capital outlay on the electrification amounted to about Rs. 942·65 lakhs, including the expenditure at Bhore Ghat and on the Kalyan power house. The annual depreciation on electrical assets has been calculated at Rs. 23·82 lakhs, while the cost of operation of the electrified services came up to Rs. 72·85 lakhs in 1930-31. The electrification has avoided a certain amount of expenditure on steam assets, and the consulting engineers have estimated the extra steam outlay that would have been necessary at Rs. 176 lakhs, while the value of the steam stock on the opening of the electrified services has been reckoned at Rs. 173 lakhs. The depreciation on this total outlay of Rs. 349 lakhs works out to Rs. 8·84 lakhs per annum, which sum has to be deducted from the annual depreciation of electrical assets to arrive at the net additional depreciation chargeable to electrification estimates. This figure, then, amounts to Rs. 15·01 lakhs. The net savings in working expenses due to electrification for the year 1930-31 are approximately:

Estimated steam operation expenses ..	Rs. 116·38 lakhs.
Less	
Cost of electrified services	Rs. 72·85 lakhs.
Extra depreciation	Rs. 15·01 lakhs.
Total	Rs. 87·86 lakhs.
Savings for 1930–31	Rs. 28·52 lakhs.



Map of G.I.P. Railway electrified system

The cost of operation of electrified services in 1931-32 amounted to Rs. 66·83 lakhs and the corresponding savings are calculated to be Rs. 32·51 lakhs. These savings represent a return of 3·03 per cent. in 1930-31 and 3·4 per cent. in 1931-32.

A similar analysis of the working of the electrified suburban services of the B.B.C.I. Railway is now possible. The suburban lines traverse thickly-populated areas in which public health authorities were faced with the important problem of the abatement of the smoke nuisance caused by the operation of frequent steam services. The B.B.C.I. administration sought to minimise this nuisance by the use of high-grade Welsh coal imported at heavy cost. The electrification of the B.B.C.I. suburban section had for its principal object the provision of clean and rapid transport at a cheaper cost. The original estimates of the consulting engineers placed the gross outlay on electrification at Rs. 204·28 lakhs (£1,530,000). In the absence of electrification, however, considerable capital outlay would have been necessary for the provision of quadruple track, and additional rolling stock, to cope with the growing traffic. Taking these into consideration, the net additional outlay on account of electrification was estimated at Rs. 82·28 lakhs or £617,000 approximately. The consulting engineers estimated the progressive growth of traffic to necessitate the operation of 1,606,000 steam-train miles in 1931-32, and the direct dependent cost of several items of operation involved in working this traffic under steam traction was reckoned to be about Rs. 37·5 lakhs (£281,250). Similar costs of electric working, excluding depreciation, were calculated to be just over Rs. 21 lakhs (£157,500) while the depreciation on the net additional outlay was worked out to be about Rs. 2·46 lakhs (£18,450). A net saving of Rs. 14 lakhs or £105,000 per annum was accordingly expected as a result of electrification, representing a return of 6·82 per cent. on the gross outlay, and of 16·93 per cent. on the net additional outlay.

The train mileage actually operated electrically in 1930-31 was equivalent to only 1,427,000 steam-train miles, falling much short of the estimated figure for the year. The cost of working this traffic by steam has been estimated to be about Rs. 27·27 lakhs (£212,000), on the basis of the figures adopted by the consulting engineers in their original estimates with allowances for the lower cost of coal. The actual cost of operation of the electrified services in 1930-31 amounted to Rs. 22·51 lakhs or £168,825, excluding depreciation charges, which has been estimated to be about Rs. 1·87 lakhs (£14,025) after making due allowance for the cost of steam rolling stock released and other such factors. The net saving in working expenses is thus Rs. 3·89 lakhs (£29,175), showing a return of 1·92 per cent. on the actual gross outlay of Rs. 202·9 lakhs (£1,520,000) and of 6·26 per cent. on the net additional outlay of Rs. 62·11 lakhs (£465,825).

Calculated similarly, the savings in working expenses for the year 1931-32 amount to Rs. 5·14 lakhs, showing a marked improvement over the figures for the previous year. This is equivalent to a return of 2·53 per cent. on the gross outlay and of 8·28 per cent. on the net outlay.

CENTRAL ARGENTINE RAILWAY ELECTRIFICATION

Despite depressed conditions, the electrified suburban lines have shown considerable increases in traffic

Six-car suburban train on the broad-gauge lines out of Retiro terminus, Buenos Aires

THE electrification of the Buenos Aires suburban lines of the Central Argentine Railway was completed in 1931, and since December 1 of that year all suburban traffic has been handled by electric traction.

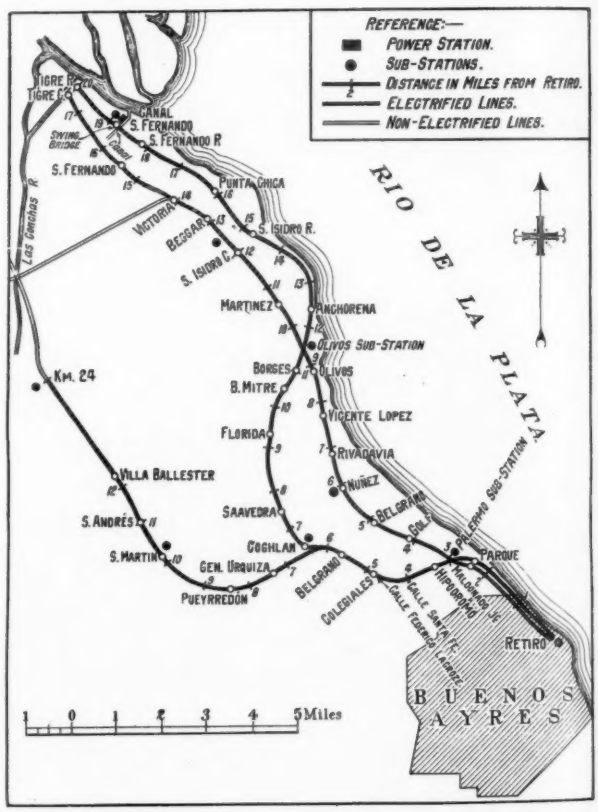
The suburban lines consist of three separate routes. The electrification of the first of these lines, to Tigre " C," was completed in August, 1916. Due to the war and other causes, the electrification of the other two routes—to Tigre " R " and to Villa Ballester—was not commenced until 1929.

The electrified system now comprises 120 track miles, including 27·2 miles of sidings, and the C.A.R. claim that it is the largest 5 ft. 6 in. gauge suburban railway electrification in existence.

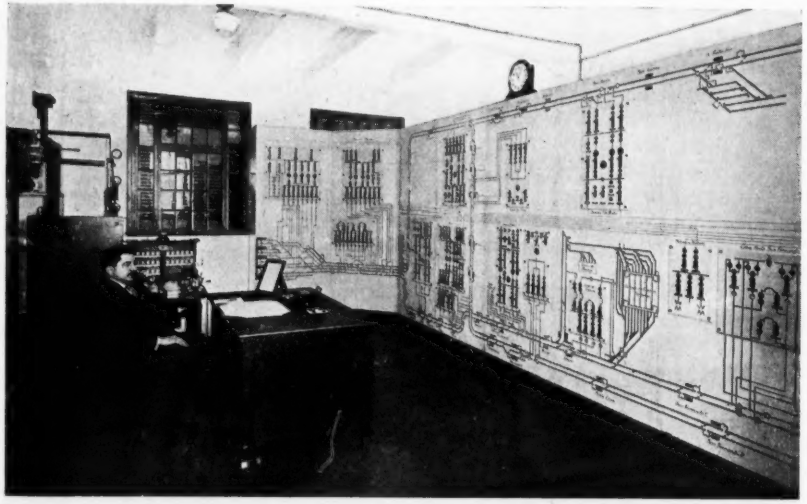
The system is entirely self-contained, current being generated at the company's power house situated on the southern bank of the River Lujan at Canal San Fernando. The installed capacity of the plant is 30,000 kW., made up of four 3,000 kW. and three 6,000 kW. Parsons turbo-alternators, the steam for which is supplied by eight 20,000 and four 50,000 lb. per hr. Babcock & Wilcox land-type boilers. The original boilers (20,000 lb. per hr. capacity) supply steam at a pressure of 210 lb. per sq. in. to the turbine stop valves, whilst the 50,000 lb. boilers generate steam at a pressure of 275 lb. per sq. in. to a high pressure header which is connected to the 210 lb. per sq. in. steam main by means of reducing valves. By this arrangement, upon a sudden heavy demand for power, reserve pressure is available and thus the pressure at the turbine stop valve remains practically constant.

Current is stepped up to 20,000 volts, at which pressure distribution to the substations is effected by means of underground cables. A 2,200-volt supply is also provided for power and lighting at stations and yards, and also for automatic signalling and train describers.

There are four manually-operated traction substations with rotary converter plant of 17,000 kW. capacity, and five supervisory controlled traction substations with a total of 22,000 kW. of rotary converter plant. From these substations, 825-volt direct current is supplied to the third rail, which is of the under contact type, protected at the top and outside by wooden boards. The five supervisory controlled substations are operated from a central control room, which is equipped with a diagram on which is

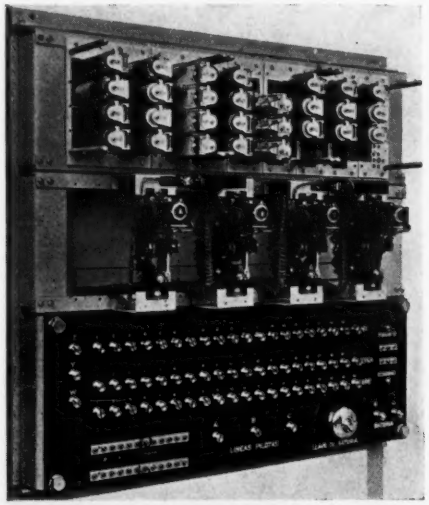


Map of the Buenos Aires suburban system of the Central Argentine Railway

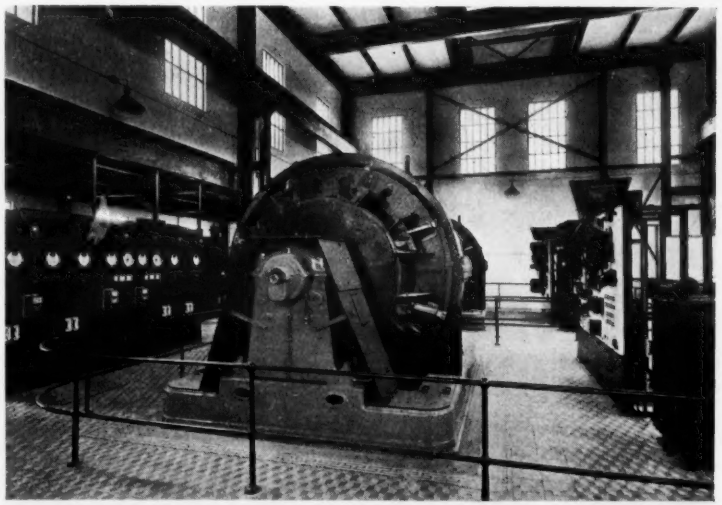


Supervisory control room with illuminated indicating board, Olivos substation

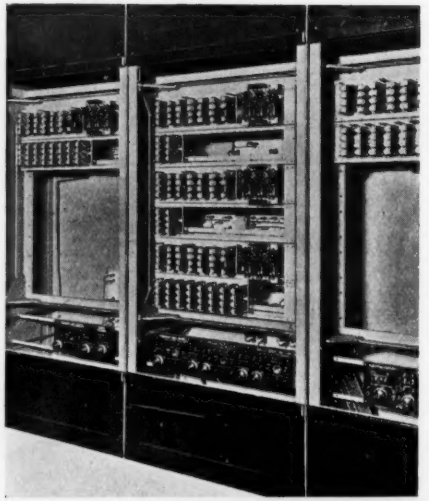
20-kV. Metro-Vick metal-clad switchgear under supervisory control, Nunez substation



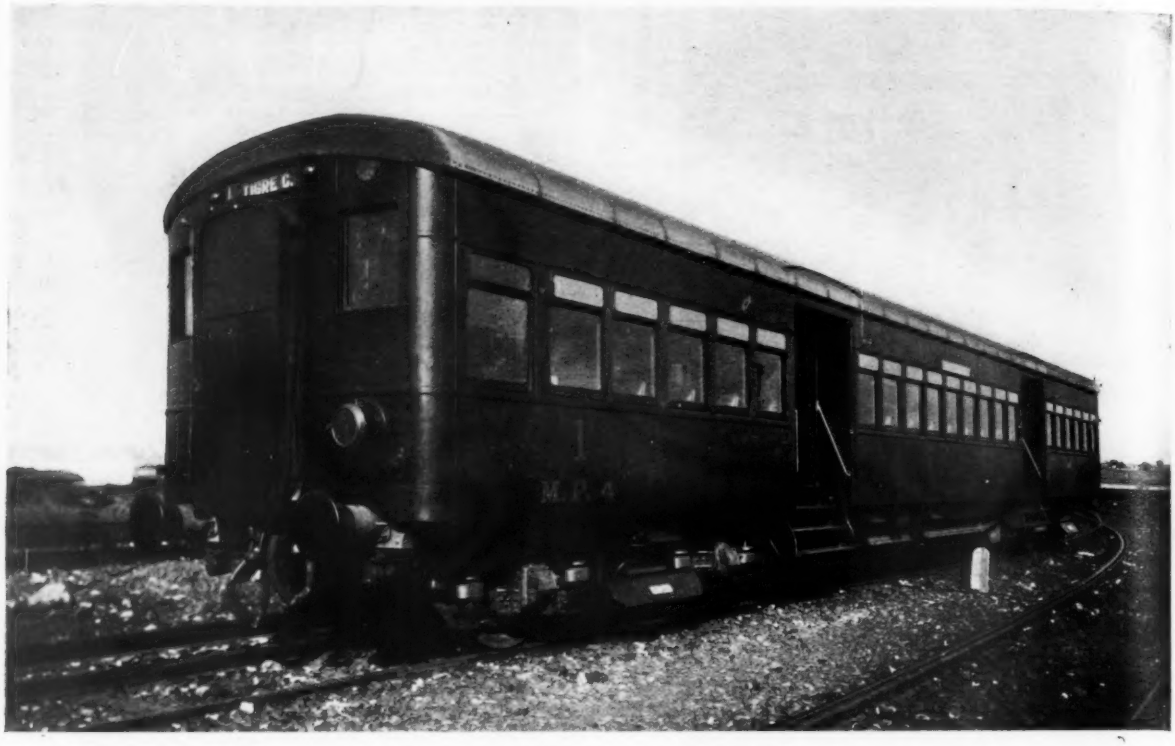
Typical substation cabinet, with cover removed



Two 2,000-kW. Metro-Vick rotary converters under supervisory control, Nunez substation



Part of operating equipment on back of control board



First class semi-steel motor-coach of 620 h.p. as running on the 800-volt d.c. Buenos Aires suburban lines of the Central Argentine Railway

shown a map of the system, the high-tension network, track-sectioning and also schematic layout of all sub-stations, both manual and supervisory controlled. The control operator is thus able to take complete charge of all switching and track-sectioning, and he actually operates all the supervisory-controlled gear and gives instructions to the manual substation attendants as regards the operations at those points. The supervisory remote control system was devised by the Metropolitan-Vickers Electrical Co. Ltd. This firm, and the British Thomson-Houston Co. Ltd., supplied practically all of the stationary and traction electrical equipment.

All track feeders are equipped with high-speed circuit breakers, and thus danger to rotary converters or their transformers from disturbances caused by short circuits on the track are avoided. A static substation is provided at Victoria for the supply of power at 440 volts to the works and other auxiliary supplies.

Rolling Stock

The rolling stock consists of 190 motor-coaches and 180 trailers, all of which are of the double-bogie type. The original stock was of wooden construction on steel underframes, but all the later stock is of steel with interior lining of wood. The firms participating in the construction were the Birmingham Railway Carriage & Wagon Co. Ltd., Metropolitan-Cammell Carriage Wagon & Finance Co. Ltd., and the Gloucester Railway Carriage & Wagon Co. Ltd.

The weight of a wooden-bodied motor-coach is 52 tons, and of a trailer of the same type 36 tons. The steel stock is slightly heavier, and the corresponding figures are 53 and 38 tons. The first class coaches, both motor and trailer, have a seating capacity of 72 and 80 passengers, according to type; the second class motors from 66 to 109, and second class trailers from 61 to 114 passengers. The reason for the wide variation of capacity of the second class stock is due to the presence or otherwise of luggage and postal compartments. An eight-coach train weighs approximately 364 tons.

The motor-coaches are equipped with two traction motors mounted on one bogie; in the original stock these motors were of 250 h.p. each, but the later motor-coaches have been provided with 310 h.p. motors with a view to improving the schedule speed. The new stock is arranged to work in multiple with the original in order that complete flexibility is obtainable. The equipment is all-electric and the coaches are connected electrically by means of two jumper cables—one being a 10-core control and the other the main-power bus line cable.

The following information demonstrates the improvements that have been made in the timing of trains due to the change from steam to electric traction, and also due to the recent demand for higher schedule speeds in order to compete with other means of transport:—

ROUTE—RETIRO TO TIGRE "C," 17·6 MILES

	Steam Service, 1915	Electric Service, 1916	Accelerated Electric Service, 1934
Total number of intermediate stops.. ..	11	11	13
Total time (minutes) ..	59	47	38
Schedule speed, m.p.h...	17·4	22·5	27·8

On the steam timetables certain express trains were run with only one intermediate stop scheduled at 35 min., whereas the present timetables include trains scheduled at 30 min. with four intermediate stops.

ROUTE—RETIRO TO TIGRE "R," 20·15 MILES

	Steam Service, 1930	Electric Service, 1931	Accelerated Electric Service, 1934
Total number of intermediate stops	13	13	15
Total time (minutes)	60	47	44
Schedule speed, m.p.h.	20·15	25·7	27·5

ROUTE—RETIRO TO VILLA BALLESTER, 12·43 MILES

	Steam Service, 1930	Electric Service, 1931	Accelerated Electric Service, 1934
Total number of intermediate stops	8	8	9
Total time (minutes)	38	30	27
Schedule speed, m.p.h.	19·6	24·8	27·6

Actually, this service is extended to km. 24 with an additional intermediate station, bringing the total distance up to 14·01 miles, for which 31 min. are allowed, giving a schedule speed of 27·2 m.p.h. for the complete run.

From the foregoing it will be seen that the improvement shown by the present electric timing, as compared with the last steam service operated on each line, is as follows, although the number of intermediate stops on each line has been increased:—

	Tigre "C" Line	Tigre "R" Line	Villa Ballester Line
Decrease in timing, per cent.	35·6	26·7	29·0
Increase in schedule speed, per cent.	55·0	36·5	40·4

At the present time approximately 500 electric trains are operated daily. Trains of varying lengths between 4 and 10 coaches are operated in accordance with the traffic demand. During the rush hours a number of express trains are run, the longest non-stop run on the present timetable being 14·4 km., for which 14 min. are allowed, this representing an average speed of 38·3 m.p.h., including speed restrictions outside Retiro and at Maldonado.

Contrary to the conditions in England, Sunday traffic far exceeds that of weekdays during the summer months. The two Tigre lines serve a number of popular riverside bathing beaches, and yachting, rowing and sports clubs. Traffic on these two lines increases enormously, and will be appreciated from the following:—

	Tigre "C" Line		Tigre "R" Line	
	Weekdays	Sundays and Feastdays (Summer)	Weekdays	Sundays and Feastdays (Summer)
Number of trains	215	251	135	152
Number of coaches in service	96	118	56	65

Sunday and feastday traffic on the Villa Ballester line decreases, due to the fact that the districts served are all inland, and the corresponding figures for this line are as follow:—

	Villa Ballester Line	
	Weekdays	Sundays and Feastdays (Summer)
Number of trains	152	113
Number of coaches in service	95	84

The task of dealing with Sunday and feastday traffic has been considerably assisted by the installation of automatic signalling on the majority of the sections of the riverside lines.

The passenger figures for Sundays and feastdays vary considerably, depending on weather conditions. In February, 1934, the record number of passengers carried on the electrified suburban area on a feastday was registered, the figure for the day reaching approximately 200,000, of which total about 82 per cent. was carried by the two riverside lines.

The following comparative figures are of interest and show the development which has taken place:—

	Year ending June 30	
	1917	1934
Output from power house, kWh.	9·0 millions	65·1 millions
Total coach miles	2·8 ,,	15·8 ,,
Total train miles	0·62 ,,	2·9 ,,
Total number of passengers carried	6·4 ,,	35·8 ,,

Of the total of 65,106,640 kWh. sent out from the power house, 59,185,952 units were used for electric traction, the remaining units being absorbed in train lighting and ventilation, the power and lighting network, and the Victoria repair shops. During the period July, 1933/June, 1934, the number of train-miles amounted to 2,867,877 and the coach-miles to 15,833,402, which results in a current consumption of 20·64 kWh. per train-mile and 3·74 kWh. per coach-mile. The metric ton-miles totalled 713,810,341, which represents a consumption of 82·92 Wh. per ton-mile at the power house.

The revision of vehicles is carried out in the car sheds situated at Victoria—the headquarters of the Electrification Department, and at km. 24 of the main line to Rosario, and also to a lesser extent at the terminal depot at Tigre "R." The Victoria car shed consists of 10 tracks (each track having a capacity of 10 coaches), carried on concrete beams, thus permitting access not only to underside of the bogies and underframes, but to the bogie sides with greater ease, and thus facilitates inspections. The car shed at km. 24 has 9 tracks and a total capacity of 90 coaches. Only four tracks are provided with inspection pits, the remainder being at floor level. Apart from the shed arrangements at this point, there is ample siding accommodation. Coaches enter the sheds for revision weekly.

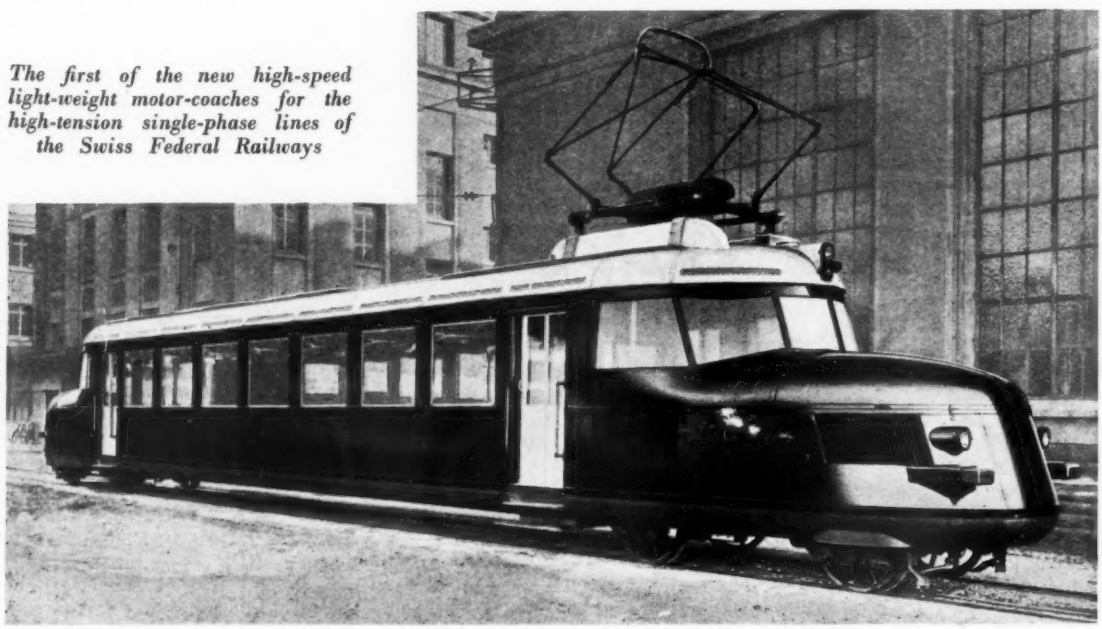
Motor-coaches enter the shops for general overhaul after running 130,000 km. (80,730 miles) approximately, in order to comply with the Argentine Government regulations. For trailer coaches, this figure is doubled before shopping for general repair, but in order to preserve a more or less uniform appearance of the coach bodies, these coaches enter after running the motor-coach mileage for exterior varnishing or painting, according to the type of coach.

XUM

NOTES AND NEWS

German Express Cars.—Trials are now being made of the first streamlined single-phase two-coach articulated sets ordered for the Munich-Stuttgart service. These sets are of sufficient power to attain 75 m.p.h. from rest in 80 seconds.

Swiss Federal Motor-Coaches.—The two semi-streamlined light-weight motor-coaches ordered from Swiss firms by the Swiss Federal Railways are now completed, and trials will commence in April. Regular service will begin with the summer timetables in May next. The design of these cars was described in the issue of this Supplement for July 27, 1934, but the appearance is shown in the accompanying illustration. These motor-coaches are to be stationed at Berne, and will work numerous services from the capital to Olten, Bienne, and Schupfen, and to Lucerne via Olten. The schedules now mapped out mean that each car will cover 579 km. (359 miles) daily. The tare weight is 32·5 tonnes, the seating capacity 70, and the maximum speed 125 km.p.h. (78 m.p.h.).



The first of the new high-speed light-weight motor-coaches for the high-tension single-phase lines of the Swiss Federal Railways

Pennsylvania Electrification Opening.—The first public through train between New York and Washington to be operated by electric traction was run last month, and the full electric service is now being gradually introduced. The time for the journey of the first train was 4¼ hours for the 225 miles, but the present schedule time for express trains is to be reduced to 3½ hours, giving an average speed of 64·5 m.p.h. On January 28, a special trial train was run from Philadelphia to Washington, and covered the 134 miles southbound at an average speed of 73 m.p.h., with a top speed reported to be 102 m.p.h. Two of the new streamlined locomotives have been on exhibition at various towns along the route.

Hungarian Electrification Extension.—The extension of the Kando high-tension 50-cycle single-phase electrification along the Budapest-Vienna main line is now completed as far as Hegyeshalom, on the Austrian frontier, and electric traction services have been gradually introduced during the past two or three months. By the end of the spring, all trains except a few country-district locals and the through Budapest-Vienna diesel railcars will be electrically hauled by locomotives built conjointly by Ganz & Co. Ltd. and the Metropolitan-Vickers Electrical Co. Ltd.

Another Swedish Extension.—The whole of the north-western main line from Stockholm to Krylbo via Upsala, a distance of 100 miles, is now electrified, and the 40-mile section between Angelholm and Halmstad, near Malmo, is to be opened to electric traction within the next two months.

Brazilian Electrification.—It is reported that in the terms of the contract for the electrification of the Central Railway of Brazil, it is stipulated that electric trains shall start to run from the Dom Pedro II terminus in Rio de Janeiro and Engenho di Dentro within 18 months of the contract actually being signed, and to Bangu or Nor Iguassu in 30 months. Two important modifications of the original conditions are reported to have been made. First, the trains are to have two classes instead of one; secondly, 100-ton electric locomotives of 2,860 h.p. are to be used in place of the 76-ton 1,580 h.p. machines originally specified. In all, 30 locomotives will be built; 9 for passenger work, 15 for through goods trains, and 6 for shunting and local services.

Ceylon Electrification.—According to the report of Messrs. Preece, Cardew, and Rider, acting as consultants to the Ceylon Government Railways, the electrification of the coast line from Colombo (Maligawatta) to Panadura, a distance of 19½ miles, could be accomplished at a cost of £192,500. Power would be obtained from the existing station at Stanley, and there is thus no need to wait for the development of the general hydro-electric scheme for the country before proceeding with conversion. The consulting engineers consider that as soon as the general hydro-electric scheme is brought into operation, the Railway Department should electrify certain hilly or densely-trafficked lines.

Extension of B.B. & C.I. Electrification.—The proposal to electrify the Borivli-Virar section of the B.B. & C.I. Railway has received the approval of the Government of India Standing Finance Committee for Railways. The question of electrification has come up for reconsideration because most of the existing locomotives and coaching stock in use on that section were approaching the end of their lives and required renewal if steam working was to continue. Among the advantages expected from electrification are the elimination of a change of trains for passengers and bazaar supplies at Borivli ; considerable saving in time in the journey between Bombay and Virar ; and an improved train service that would lead to the development of outlying areas with a corresponding increase in traffic. The total gross outlay involved is estimated at about Rs. 25.68 lakhs, of which Rs. 25 lakhs will be chargeable to capital and the balance to revenue. By taking into account the estimated outlay on steam locomotives and rolling stock entailed if the electrification scheme was not proceeded with, and also adjustments that would be necessary on account of the cost of steam stock likely to be released because of electrification, the net additional outlay is estimated at Rs. 6.78 lakhs, of which Rs. 3.37 will be debited to capital. Electric working of the section is expected to result in annual saving of Rs. 1.21 lakhs, which would justify the expenditure.

Daimana-Harrismith Electrification.—The completion of this section has added 61 miles to the route mileage of electrified railways in South Africa. A full passenger train service was introduced on February 4, and a goods service will follow at an early date. The extension embodies many features unique in railway electrification. The line rises 2,236 ft. in 35 miles, and the curvature is severe and continuous. The 88,000-volt transmission line was built on the same structures which carry the 3,000-volt direct-current overhead line equipment. All the 3,000-odd structures erected were fabricated from discarded 80-lb. and 60-lb. section rails and flattened old steel sleepers. All structures were welded electrically and no rivets were used. The substations, one at Van Reenen and the other at Colworth, have each three 2,000-kW. mercury-arc rectifiers, and at each substation the 88,000 volts a.c. is converted to 3,000 volts d.c. The locomotives are fitted with regenerating equipment. The work, which was carried out departmentally, is a record for rapid electrification ; 61 miles of 88-kV. transmission line, 71 track miles, and two traction substations were built in 16 months, at a total cost of approximately £180,000.

Lubrication of Overhead Wires

On the Copenhagen suburban lines, which were electrified in 1933-34, a new and cheap method of limiting the wear of the contact wire is being practised. The Danish motor-coaches are equipped with two pantographs each, of which only one is used at a time, and there are two contact wires, both touching the pantograph at the same time. Overhead wires and pantograph collector pans are covered with a thin coating of ERH graphite enamel, which dries in half to one minute, and which sticks to the surfaces so well that it acts as graphiting. Fine crevices and pores, which might be found in the wires and in the collector pans, are filled with graphite as the two surfaces rub over one another, and a smooth surface of good conductive capacity is obtained. This graphite cover does not burn as a result of sparking.

The graphite enamel is applied to the wires by a device consisting of a wheel running in a reservoir containing the enamel ; alternatively, there may be used a shoe into which the enamel is pumped. The enamel is very thin, and must be stirred up constantly, as otherwise the graphite will precipitate. While liquid, the enamel is a non-conductor, but congealed it is a very good conductor, comparable with dynamo brushes. It is applied to the pantographs with a soft brush. On one pantograph collector pan the copper strips were so rough and worn that it was considered unavoidable to have them mechanically smoothed. However, the enamel was first tried, and after one day in service the pantograph was again inspected, and the surface found completely smooth. How frequently this process ought to take place depends on the intensity of train service. The tramways in Copenhagen lubricate every 14 days, but the State Railways apply the enamel every day to the pantographs, thus avoiding frequent applications to the overhead wires, where it has been used only once. However, it has been decided to use it on the wires at intervals of about two months.

The necessary apparatus is mounted on a service car and the graphiting can be done in the interval between two trains, as the enamel dries up almost immediately.

Before using the ERH graphite enamel, invented and manufactured by Mr. E. R. Holm, of Copenhagen, the surfaces of the wire and pantographs must be clean, as no enamel will stick to a greasy surface. To obtain this, the surfaces are treated with a cleaning fluid to remove all grease and dirt, after which the liquid evaporates, leaving the surfaces clean and dry.

Publications Received

The Electrical Encyclopædia. Edited by S. G. Blaxland Stubbs. London : The Waverley Book Co. Ltd., 96, Farringdon Street, E.C.4. Four volumes, 10 in. × 6¾ in. 1,440 pp. Price 70s. net.—An encyclopædia is not a work for which a universal welcome is assured, an attribute traceable in part to the epidemics of such volumes which have been a feature of the last half-century. Strangely enough, electricity has been struck only slightly by the Alpha and Omega fever,and this latest production of the Waverley Book Company should therefore be greeted with fewer opprobrious epithets than fall to the lot of a more general volume. It has a further advantage, too, in that the contents do not begin with "*A*. A letter of the alphabet used to indicate an ampere," but with an extremely practical preliminary note by Mr. A. Arnold (one of the associate editors of the work) on the elementary bases and uses of electricity.

The book as a whole is characterised by balance and a sense of proportion, but we would be lacking in human nature if we did not express a wish that more attention had been given to electric traction. The chapter by Mr. A. T. Dover on this subject is quite good, and contains scarcely any inaccuracies, but we think a little more space might have been devoted to individual axle drives, of which only the Brown Boveri and Westinghouse types are illustrated. So far as traction work is concerned, this chapter is supplemented by the references made in other sections to such details as rectifiers and substations, and we were glad to see that adequate space was devoted to the remote control of substations, and to the possibilities of both steel-tank and glass-bulb rectifiers for railway work. The complete production contains over 1,900 illustrations (of which the numerous line diagrams are very clearly reproduced) and certainly justifies the editor's claim that an encyclopædia is more than an enlarged dictionary.

XUM

AUXILIARY POWER FOR ELECTRIC TRACTION EQUIPMENTS

The auxiliary supply considered mainly from the lighting aspect

By E. H. CROFT, A.M.I.C.E., A.M.I.E.E.

THE use of d.c. voltages of 1,500 and over for traction equipments demands the most careful consideration of the auxiliary supply. The provision of the supply is not always simple, due to the following considerations:

1. Large variation of line voltage.
2. Tendency towards large voltage drop, due to voltages used and small size of generators.
3. Danger of parallel running.
4. Danger of overloading and necessity of an alternative supply in emergency.

Line Variation and Voltage Drop

As both these factors have the effect of varying the auxiliary voltage they may be taken together. In considering traction voltages, the following terms are used:—

Maximum line volts is the highest voltage met; it has relatively short periods of duration.

Nominal line volts is the normal design value, and is of little technical importance.

Average line volts is the usual tension existing in the contact wire and is of great importance, as the traffic performance of the coaches is based upon it.

Minimum line volts is the lowest voltage met under normal conditions, such as rush hours and overloading of the line.

Emergency minimum line volts is the lowest voltage likely to be met in an emergency, such as failure of a substation. All apparatus must operate safely on this voltage so that traffic is not held up.

The table below gives examples of these voltages for four electrifications.

D.C. Voltage	Case A	Case B	Case C	Case D
Maximum	1,550	1,500	1,600	1,600
Nominal	1,500	1,500	1,500	1,500
Average	1,400	1,450	1,350	1,400
Minimum	1,150	1,250	1,200	1,100
Emergency minimum	800	800	1,000	800

Case A is probably the range most likely to be met and will, therefore, be used as a basis. The auxiliary supply is supplied in most cases by a generator or rotary transformer, and the load is control and lighting. Capacities vary between 2 and 12 kW., and voltages from 24 to 750; a common voltage is 100, and this will be considered as a basis. The control solenoids can easily be made to operate at values of 50 per cent. normal volts, but the higher this value is the cheaper the control apparatus.

Since lighting on a varying voltage presents difficulties, the auxiliary supply must be considered from the lighting aspect. For many years line voltage lighting with lamps in series has been successful on 500 to 800-volt d.c. systems, and even higher on the Continent. The next table gives the line voltage, and lamp voltage variation for two typical cases.

Voltage	Case A Line	Case A Lamp	Case B Line	Case B Lamp
Maximum	630	126	650	130
Rated lamp voltage..	—	110	—	120
Average	550	110	580	116
Minimum	450	90	400	80

This table indicates that Case A withstands occasional 14 per cent. over voltage, and Case B occasional 8 per cent. over voltage. The life of incandescent tungsten filament lamps is reduced or increased by approximately 14 per cent. for every 1 per cent. increase or decrease respectively in the voltage applied to the lamps. The periods of voltage above the average are not of very long duration, and are balanced by periods below the average voltage, which also are not of long duration.

Consequently, it is found in practice that on traction systems the life of the lamp is not appreciably affected by occasional over voltages, and as indicated from the above table and also further evidence, occasional over voltage of 12 per cent. will not seriously affect the life of the lamp, since the decrease in length of life at the higher voltages is more or less balanced by the increased life of the lamp when burning at the lower voltages.

The table also shows that passengers have been satisfied with lighting run at very low voltages momentarily, and, for the sake of consideration of basic principles, it will be assumed that the maximum voltage may be 112 per cent.

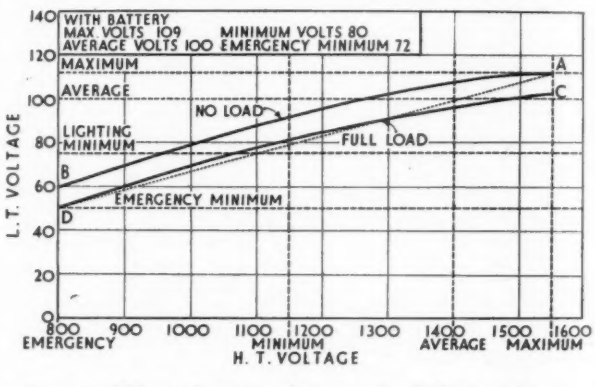


Fig. 1—Effect of voltage drop on the lighting voltage at full and no loads

and the minimum voltage 75 per cent. In connection with the minimum voltage, it must be fully realised that a reduction of 1 per cent. in the voltage applied to a lamp will reduce the output by about 4 per cent. and consequently the lighting cannot be considered ideal or luxurious. Such conditions have been considered satisfactory in the past, and are still satisfactory for a number of conditions. They account, however, for the tendency to introduce voltage regulators.

The effect of voltage drop is often not appreciated. Fig. 1 is an approximate diagram indicating the full effects of voltage drop on the lighting voltage. Assuming 100-volt traction lamps, the maximum low-tension volts at light load, and full line volts is 112 volts (Point A). Curve A B indicates a generator characteristic on light load, while the curve C D represents the characteristic of the same machine on full load. Since the low-voltage variation corresponding to the line voltage range 1,150-1,550 is within 12 per cent. high and 25 per cent. low, and since the emergency minimum is 50 per cent. of normal, one

might consider that the characteristic was acceptable, but actually it is unsuitable since:

(*a*) At light loads the average voltage of the lamp will be in excess of 100, namely, 108, and the lamp will suffer.

(*b*) At full load (the time when passengers are using the lights) the average voltage will be low, namely, 96.

Consideration of these two points shows that any appreciable load drop is unacceptable. If the load drop were eliminated and a straight line curve A D were possible, then the total voltage variation would remain the same, but the characteristic would be acceptable, as the lights at full load and light load would have the correct average voltage.

Many machines using various combinations of compound fields have been produced and are operating satisfactorily. The difficulties in design increase as the size increases, and the machines tend to become heavy and complex. The use of voltage regulators has never met with much popularity in the past, but the constant demand made by passengers for luxury has resulted in some of the more recent multiple-unit stock being fitted with

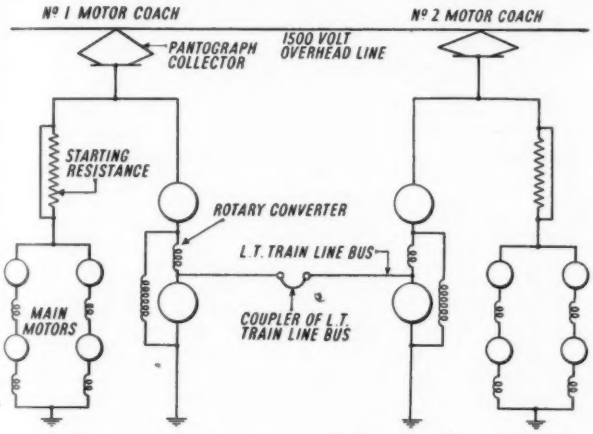


Fig. 2—Power and auxiliary circuits of two-coach train

voltage regulators. Obviously these fittings must be of the quick operating type, which means a carbon pile, vibrator, or face plate type. The disadvantage is that of increased maintenance and liability to failure.

Whatever system of supply is arranged, other than a direct feed from the line, a battery in parallel is very desirable, as it has the following advantages:—

(*a*) It gives an emergency supply for the passenger lighting, avoiding complete darkness in event of failure of supply, or failure of various items of apparatus. This emergency supply cannot be arranged in any other way.

(*b*) It gives an emergency supply for inspection lights, which will almost always reduce time of delays in case of failure.

(*c*) One simple high-tension chamber is required instead of two, since where no battery is provided an inner high-tension chamber is required for compressor and motor-generator set control, so that these may be left running when the outer chamber is entered for routine inspection.

(*d*) Due to simplified high-tension chamber the apparatus can often be housed in less space, resulting in either easier maintenance or greater passenger accommodation.

(*e*) It simplifies the control of the high-tension auxiliaries and pantograph, as it eliminates the dual remote control and hand control necessary where a motor-generator set has to be started before a low-tension supply is available.

(*f*) It can supply a fair degree of voltage regulation, and will definitely increase the minimum and emergency voltages. (See Fig. 1.)

(*g*) It reduces the danger of overloading motor-generator sets by being able to share the load for reasonable periods, and allows schemes to be used which entirely eliminate any possibility of overloading.

The cost is easily borne by the reduction in cost of the

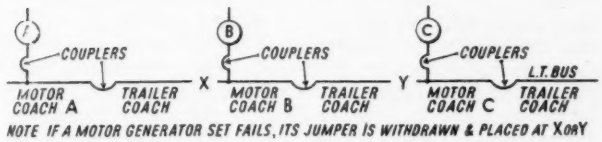


Fig. 3—Wiring diagram showing method of providing alternative supply when no battery is carried

h.t. chamber, auxiliary and pantograph control, together with the reduced maintenance charges, and reduction in delay time.

Danger of Parallel Running

Fig. 2 represents, in simple form, the power and auxiliary circuits of a train containing two motor coaches. The l.t. supply is by means of dynamotors or rotary converters, and a train-line bus is shown paralleling the l.t. supply. It is assumed that due to some intermittent trouble the pantograph of No. 2 coach is not making contact with the overhead line. The power circuits remain closed and thus the l.t. machine on No. 1 coach attempts to drive the l.t. machine on No. 2 coach, so that it may feed the main motors. The result is the equivalent of a short circuit on both machines.

By means of high speed no-volt relays on each motor coach, the danger can be largely overcome. The same result can be obtained by high-speed circuit breakers on the l.t. side. The most satisfactory method is to arrange the l.t. circuits so that there is no bussing of generators.

Necessity of Alternative Supply

The possibility of failure of control and lighting supply is definitely greater in the case of high-voltage systems, since apart from failure due to collector systems, which is much the same risk in all cases, there is the added possibility of failure of the auxiliary generators and their associated control gear. It may be suggested that running the low voltage generators in parallel would have advantages, but these are more than outweighed by increased possibility of overloading the machines. It is obvious that in all cases some emergency supply is required to give at least partial lighting and control current to let a train complete its trip and get clear of the traffic.

Many wiring schemes are available for meeting various connections. Fig. 3 represents a method that can be adopted in cases where no battery is used. In this arrangement an l.t. train line runs through the train, and each coach is provided with a jumper. This jumper is used in the case of the motor coach to connect the motor-

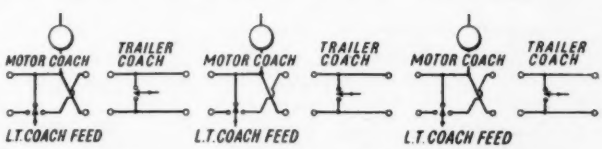


Fig. 4—Diagram showing a method of obtaining an alternative supply by the use of two train lines

generator set to the train line. Normally each motor-coach feeds the associated trailers, and no jumper is available to connect the line from motor-coach to motor-coach. In event of failure of one motor-generator the jumper is withdrawn from it, leaving it isolated, and used to connect the l.t. circuits to the adjacent motor-coach.

Fig. 4 shows a more elaborate system which has also proved itself in practice. It requires two train lines, but is quicker to operate in emergency than that shown in Fig. 3. In this system two l.t. train lines are provided;

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bifurcation is not shown, but can be introduced if required. The l.t. load is taken from either one or other line on the trailer coaches by means of a selector switch, and taken from a three-point switch on the motor-coaches; thus the feed can be obtained from either the motor-coach itself, or a motor-coach to the left or to the right, depending on circumstances. Normally the feed is taken from the coach itself. Coach couplers always remain in.

From examination of the above schemes it will be realised that although the scheme in Fig. 4 is rather more mistake-proof, both types avoid parallel running of generators and both allow the supply to be obtained from an adjacent motor-coach in emergency. They do not prevent overloading the machines under emergency conditions; this can be avoided by careful instructions or by additional complications. Some railways have had the motor-generator set of such a capacity that they could handle emergency conditions. This is not to be recommended. It will be appreciated that the above mentioned schemes, even developed so as to avoid entirely any danger of overloading, do not provide an alternative supply when an h.t. failure occurs on the line, or when a failure occurs on a train containing one motor-coach. They are, therefore, both inferior to a system using a battery.

Conclusions

Certain important emergency conditions are only met by a battery, and the cost of the battery is easily met by the simplification of the equipment in other respects, with consequent reduced cost of maintenance since the possibility of a lighting failure hardly exists. The motor-generator may take many forms, the most suitable form being one in which compound fields are used on both motor and generator; such a machine can be made simple and stable. The machine must be capable of being started without the use of any complicated starting equipment. The h.t. and l.t. windings should be kept well apart and arranged so that failure causes breakdown to earth and not h.t. to l.t. A voltage regulator is not recommended for the majority of schemes, but may be required in special circumstances. If used, it must be of a quick action type.

Fig. 6 shows a proposed l.t. supply system which it is claimed has the advantages of simplicity, cheap first cost, cheap maintenance. It prevents paralleling and overloading of motor-generator sets, and meets all emergency requirements. Each motor-coach is provided with a motor-generator in parallel with a battery, with a suitable battery cut-in and cut-out switch. The l.t. feeds are led to a two-point coupler at one side of each end. A double-pole insulated system is adopted (shown earth returned in Fig. 6 for simplicity) instead of earth return, to avoid irregular rail currents passing along the h.t. circuits in abnormal circumstances (See Fig. 5). This illustration shows how bad rail contact through sand or grit on the rail causes h.t. current of the first motor-coach to flow to

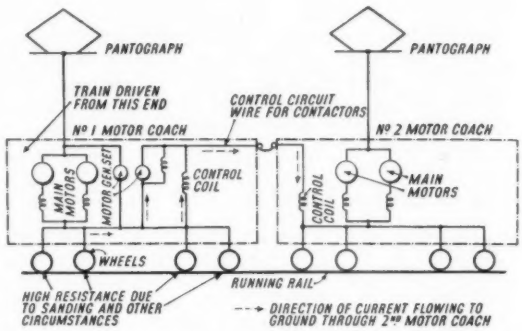

Fig. 5—Double-pole insulated system used in order to avoid irregular rail currents passing through the h.t. circuits

the ground on the second motor-coach along the control lines, resulting in blowing of fuses and slight danger of shock.

In the system recommended, all motor-coaches are similar, all driving trailers are similar, and all trailers are similar; any amount of reversal of position on the rails of individual coaches has no effect on the functioning of the couplers, and all practical arrangements of motor-coaches, trailers, and driving trailers are met without danger of parallel operation of the l.t. supply, the need of operating any changeover switches, or the danger of overloading the machines. Fig. 6 shows a number of combinations clearly to illustrate the adaptability of the system.

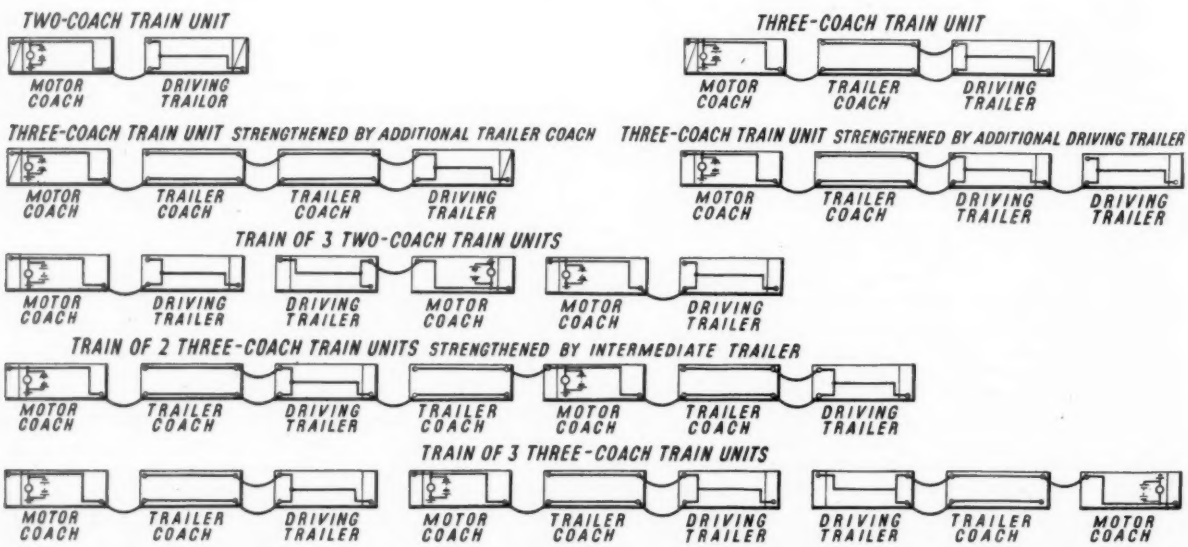

Fig 6—Diagram showing several combinations of a recommended method of obtaining an alternative supply for auxiliaries